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## A REPORT ON SOME MIOCENE DIPTERA FROM FLORISSANT, COLORADO

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Florissant, Colorado, is justly famous for the multitude of fossils that have been discovered there. In Miocene times the region was the scene of intense volcanic activity. Subterranean explosions now and again showered poisonous fumes and fine ashes on the creatures of the area to overwhelm and bury them. Outbursts of molten lava descending on shallow Lake Florissant and the adjacent swamps boiled the water and baked the silt into shale. Ants and beetles crawling over the marshland were entombed. Insects flying over the water instantaneously perished, dropping to the surface, and then were carried down by the cloud of volcanic dust falling upon them. As they lay sprawled out, some flat, others on their side, many left an imprint in the accumulating silt. Perhaps the sulphurous gases preserved them from immediate decay, or their bodies were sterilized in the boiling water, which might account for the astounding number of fossilized specimens now being uncovered in this locality.

It is interesting to note that frequently the expanded abdomens of the fossils, evidenced by the wide interstices between the sclerites, suggest an internal bloating while the insects were being encased in the drying mud, as if they had been boiled. In Yellowstone National Park, insects can be seen to drop in their flight over the fumaroles and hot pools. Their bodies when seen in the water show a similar puffing of the abdominal segments. Were they to be covered with ashes they might easily duplicate the conditions at this Miocene fossil bed. The prevalence of

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Chironomidae, Bibionidae, and Empididae in the Florissant beds might even time most of the cataclysms as having occurred in the spring of the year.

As layer upon layer of volcanic ash accumulated, with alternate inundations and desiccations of the lake bed, the strata flattened by their own weight. The fossilized insects, fish, and plants were crushed to an infinitesimal thinness, sometimes leaving a carbonized deposit like a silhouette, or else an imponderable print like a photographic image, often with an iridescent sheen, especially on the abdomen. The shale rock thus formed can now be readily split into thin lamellae. Most of the disclosures naturally are devoid of fossils, but the thousands of specimens of insects that have been discovered in this limited area attest an extraordinary abundance and variety of insect life in that far-gone time.

When insects are collected in any locality it is commonly noticed that some species are abundant in individuals and others are rare. It is not strange, therefore, that many of the Florissant Miocene species are represented by single specimens. Some forms, like *Chironomus* and *Bibio*, evidently perished in swarms, but the large number of uniques in the collection suggests a rich fauna still to be encountered.

It is of interest to note that heretofore 167 species of Diptera have been described from Florissant, of which Cockerell contributed 85, Scudder 53, of which 51 are Tipulidae, James 12, Hull 11, Melander three, Brues two, and Johannsen one. The present study adds 62 new species, besides recognizing 22 of the previously described species. Three of the species have been placed in new genera, the significant point of which is not that three genera have become extinct, but that 55 of the new species can be assigned to genera persisting today. In addition to the material reported on, the collection contains some more species which are represented by specimens too imperfect for accurate determination.

While many of the Florissant fossils are wonderfully preserved, sometimes with the microscopic hairs as plainly visible as in existing species, the vast majority are imperfect or fragmentary in some respect or other. Too often some important taxonomic structure is obliterated, which complicates the placement of the specimen. By tilting the stone at different angles under the binocular microscope and varying the direction of spot-light

illumination it is surprising how often illusive venational characters can be brought into view. Sometimes moistening the stone will afford for a brief time a greater contrast between the specimen and the matrix. Specimens mounted under Canada balsam and a cover glass show to advantage, a treatment especially desirable when certain shales slake and flake off.

When the collector separates the laminae of shale and a specimen is found, usually most of the insect, as far as it is preserved, is disclosed at once. Outlying parts, like antennae, tarsi, and the tips of the wings, may still remain hidden because the stone did not fracture properly. A mounted needle, ground to a micro-chisel end, is then useful to dissect off the bits of shale and often can expose important structures. It affords one a deep feeling of veneration to watch under the microscope the uncovering of structures entombed 10 million years ago.

For the Florissant Diptera there has been surprisingly little evolutionary change since the Miocene. Wing patterns conform in nearly every instance to those of present-day genera. Most of the species can be rated in terms of the modern fauna. Sometimes even the species present no special difference from certain living forms. Such fixation of structure seems remarkable when we consider the innumerable generations that have elapsed since the time when the Florissant specimens were laid away. Evolutionary development of genera and species took place long before Miocene times.

But in identifying the members of the collection under study not every individual affords worth-while information. Some structures, like setae, pubescence, or weak veins, rarely are completely preserved. If the insect died with the two wings overlapping it may be difficult to discriminate between the veins. When flattened to a single plane the dorsal and ventral structures are superposed. If parts of the insect were at an angle to the plane of fossilization measurements may become deceptive, for example, when one apparently short femur projected upward and its normal mate was outspread. There might even have been some distortion as the sediment became impacted. This is sometimes noticeable in disagreements when micrometrically measuring the cells of the two wings. Previously was mentioned the frequent puffing out of the abdomen which would make the body measure longer than it was before death.

Since the fossils in the shales, unlike those in amber, lack

many details of structure, their descriptions of necessity are brief. Measurements with the micrometer are presented, as a matter of record, but it is realized that such exactness is more a description of the fossil specimen than of the species. When measurements of a curved line are given the size is the straight-line distance between the designated points. It has been the custom to include the extent of fasciation of the abdomen in the diagnoses of species, though the dark and light alternate banding may represent individual bloating rather than the original color pattern.

The present study considers the Diptera collected by the American Museum of Natural History expedition to Florissant, Colorado, in 1906 (the references indicated by A.M.N.H.), together with some material from the R. D. Lacoe collection belonging to the United States National Museum (designated hereafter as U.S.N.M.), supplemented by a few specimens from the British Museum (Natural History) and one from the University of Colorado. The National Museum material was collected at Florissant and bears various lot numbers. Dr. R. S. Bassler, Head Curator of the Department of Geology, states that the lot numbers do not indicate localities or strata at Florissant, but only accessions to the Lacoe collection. Therefore the numbers are not given with the following descriptions.

The specimens belonging to the American Museum of Natural History were found by Professor and Mrs. T. D. A. Cockerell, Professor W. M. Wheeler, and Mr. Sievert A. Rohwer. The exact sites, as marked on most of the specimens by station numbers, have been described by Cockerell in the Bulletin of the American Museum of Natural History (vol. 23, pp. 127-132, 1907). Credit is given the collector where the specimens have been initialed. Probably most of the large number of undesig-nated specimens were discovered by Professor or Mrs. Cockerell.

For future identification purposes the specimens have been given a study number, inscribed in India ink at the margin of the stone, rather than by affixing labels which might become detached. However, specimens since assigned catalogue numbers by the United States National Museum (U.S.N.M.), the American Museum of Natural History (A.M.N.H.), or the British Museum (Natural History) (Br.M.N.H.) have been referred to, throughout the present report, by these catalogue numbers rather than by their original study numbers. The measurements given

in the descriptions are in millimeters and fractions of millimeters, unless microns ( $1/1000$  mm.) are indicated. The photographs have been made by a variety of cameras and lenses. Generally, a long bellows and long-focus lens were used, the illumination being variously one or two miniature arc lamps, or an electric bulb spot light, or photo flood lights, the photographs being taken on slow contrast plates. Sometimes to increase contrast and bring out detail the specimen was moistened with glycerine during the long exposure, and sometimes a color filter was used. The enlarged unretouched photographs, it may be stated, are superior to the actual specimens in contrasting the fossil from the matrix. To show the varying degree of magnification the size of the original specimen is given in the captions to the figures.

#### TIPULIDAE

##### *Tipula wilmatteae*, new species

##### Figure 2

A larva, represented in profile by the posterior six or seven segments, was discovered at Station 14, Florissant, and is provisionally referred to the genus *Tipula*. The body apparently was stoutly terete, somewhat tapering caudally, without tubercles or spines, the posterior end expanding into six subequal anal lobes. No hairs or setae are visible, other than two bristles, one above the other, on the side of the antepenultimate segment. The body is almost colorless, except the last two segments which in the fossil are quite blackish, including the backward projecting processes. A discoloration extends along the lower part of the body, probably indicating the alimentary tract.

Scudder enumerated 51 species of Tipulidae from the Florissant shales, all in the adult condition, and in the collection under study there are upwards of a hundred tipulid flies. The present fossil is the first indicated discovery of a crane-fly larva. The relation of this larva to the adult flies probably can never be ascertained, so the species name will be a permanent recognition of the collaboration of Mrs. Wilmatte Porter Cockerell in assembling the Florissant collection for the American Museum of Natural History.

HOLOTYPE (BY MONOTYPY): A.M.N.H. No. 26452.

***Tipula florissanta* Scudder**

## Figure 3

In the Florissant material studied by Scudder, this is the commonest species, represented by 55 specimens. One of his paratypes in the United States National Museum collection before me compares with five specimens from the American Museum and five more from the National Museum. It is quite probable that these are not all the same species, as they come from different strata; of the American Museum lot two specimens (A.M.N.H. No. 26453/1) were collected by Wheeler at Station 14, two others (A.M.N.H. No. 26453/2) by Wheeler at Station 11, and A.M.N.H. No. 26453, a hyaline wing on pale gray shale (fig. 3), came from Station 13.

***Tipula limi* Scudder**

A female in the Lacoe collection of the National Museum traces to this species. Its wings show a fainter clouding than Scudder indicated, but the pattern conforms. The wings are on the borderline for size, measuring 19 mm. in length and 5 mm. in width.

***Tipula heilprini* Scudder**

A detached wing, 22 mm. long, from Station 14, A.M.N.H. No. 26454, agrees with the figure in Scudder's "Florissant Tipulidae" in neurulation and in showing the stigmatic and pre-apical clouding. In addition there is a small cloud surrounding the base of the prefurca.

***Tipula lapillescens* Scudder**

A female faintly marked on the shale, from Station 14, Florissant (A.M.N.H. No. 26455:1), is probably this species. It does show a maculation of the wing agreeing with Scudder's figure 3 of plate 9. A dislocated wing from the same station (A.M.N.H. No. 26455:2) has but a faint indication of the wing picture. In both specimens the m-cu cross vein does not quite reach the discal cell, being separated from it by the blunted end of the second basal cell.

***Tipula maclurei* Scudder**

A female from Station 14 (A.M.N.H. No. 26456:1) with darkened abdomen and maculate wings seems to be this species

though it is somewhat smaller than the type, the wing measuring about 20 mm. in length. Both halves of the fossil are represented, though the anterior part of the insect is wanting. The specimen was received from Professor C. T. Brues, who discovered the fossil by splitting a bit of shale that showed another insect on a different layer. A dislocated wing (A.M.N.H. No. 26456:2) shows the same color pattern.

### ***Tipulidae distincta* Scudder**

A well-preserved female in profile in the Lacoe collection (U.S.N.M.) is assignable to this species. The venter is quite dark.

### ***Helius faecarius* Scudder**

This species, described as *Rhamphidia*, is represented by a well-preserved specimen in obverse and reverse, from Station 13, Florissant (A.M.N.H. No. 26459). The specimen agrees so well with the description and figure that there is no doubt about the identification.

### ***Cladura integra* Scudder**

A specimen of this species was collected at Florissant (A.M. N.H. No. 26460). The venation of one wing is well preserved and agrees with the description and illustration in Scudder's "Florissant Tipulidae."

### ***Cyttaromyia clathrata* Scudder**

One specimen in the Lacoe collection (U.S.N.M.) shows the characteristic neuration of this genus, with the first posterior cell divided to form an extra cell above the discal cell. It keys to *C. clathrata*, though it is slightly larger than Scudder's specimens.

### ***Limnoscema marcescens* Scudder**

A female specimen found at Florissant Station 14 (A.M.N.H. No. 26461) agrees well with the figure and description given by Scudder. The cross veins are obliterated so the wings appear to possess only longitudinal veins. Abdominal incisures strongly marked.

## MYCETOPHILIDAE

***Boletina hypogaea*, new species**

Figure 10

Length 5.1 mm. Head and mesonotum black, pleura probably brownish, abdomen as preserved iridescent piceous, greatly distended, with the membrane colorless between the sclerites. Antennae scarcely twice the head height, rather stout, proboscis not projecting. Legs long and slender, light brown. Bristles of body not preserved; the apical spurs of tibiae strong, but no extensor tibial spines showing. Wings 3.75 by 1.45 mm., quite strongly and uniformly infumated, overlapping but not coinciding, the venation therefore confused, auxiliary vein 1.2 mm. long and ending in costa, first vein ending 0.75 mm. before level of wing tip, third vein ending before wing tip, prefurca of fourth vein about 0.35, upper branch of fourth vein ( $M_{1+2}$ ) 2.1 mm.

HOLOTYPE: U.S.N.M. No. 112571 (R. D. Lacoe collection) Miocene shales, Florissant, Colorado.

A beautiful specimen, but the superposition of the wings and lack of somatic bristles preclude exact generic placement. Compared with several existing species of *Boletina* the fossil agrees well. Scudder has described three other species of *Boletina* from the Tertiary of British Columbia and Wyoming.

*Hypogaea*, Greek *ὑπόγειος*, from under the earth.

***Exechia priscula*, new species**

Figure 9

Length 5.5 mm.; head 0.6, thorax 1.2, abdomen 3.9; wing 3.3 mm. A light brown species, the humeri and under side of body and the legs paler, wings slightly infumated, with base and apex subhyaline, veins light fuscous. Spurs of hind tibiae long, the extensor setae short. Subcosta very short, ending in the radius, transverse fork of radial sector 1 mm. from humeral cross vein, 1.2 mm. from end of first vein, and 1.6 from end of the nearly straight third vein, r-m cross vein strongly reflexed, 0.25 mm. long, fourth vein between fork and cross vein 0.1 mm., i.e., the fork is before the end of the first basal cell, cubitus forked much beyond medial fork, the anterior branch arched. Middle abdominal segments darker in front than behind.

HOLOTYPE: A.M.N.H. No. 26462, from the Miocene shales at Florissant, Colorado, discovered by William M. Wheeler. Un-



questionably the species is to be located in the modern genus *Exechia*.

*Priscula*, neo-Latin, rather ancient.

### PROAPEMON, NEW GENUS

First radius reaching apical third of wing, radial sector forked just beyond end of  $R_1$ , the anterior branch forming an acute angle, ending in costa about two-fifths the distance between the tips of  $R_1$  and  $R_5$ ; no r-m cross vein, the two veins fused for a short distance beyond the first basal cell; base of media weak but dividing the two basal cells and extending to the m-cu cross vein, thence after the fusion with the radial sector forming a short pedicel to the two branches of the media;  $Cu_1$  twice angulate at the end of the second basal cell,  $Cu_2$  distinctly arcuate. Three uniform ocelli widely spaced on a gentle curve; second antennal joint cylindrical, about four times as long as the diameter, microscopically hairy, the joints of at least basal part of flagellum square and bare, but not so sturdy as in *Apemon*; palpi apparently incurved. Legs long and slender; abdomen and femora clothed with rather long hairs, tibiae and tarsi with close-set microscopic hairs; the hind tibiae with some short scattered setulae, as in *Apemon*. The condition of the proboscis and the length of the subcosta cannot be stated.

GENOTYPE: *Proapemon infernus*, the species following.

This fly is closely related to *Hesperodes* and *Apemon* in the Ceroplatinae. Its wings are very similar to the diagrammatic figure of *Hesperodes* given by Johannsen in the "Genera insectorum," fascicle 93, and Bulletin 172 of the Maine Experiment Station. The new genus differs from *Hesperodes* in having three distinct ocelli and a long antennal scape. From *Apemon* it is distinct by having the anterior branch of the third vein,  $R_{2+3}$ , ending separately in the costa, a generalized condition, as well as by its lengthened antennal scape.

### *Proapemon infernus*, new species

Figure 5

Length about 6 mm.; thorax 1.6, abdomen 4.5; wing about 4.8 mm. Apparently a testaceous species, mesonotum posteriorly probably with two narrow darker vittae, notopleural suture and sternopleura marked with brown, legs light colored, wings

infumated, probably with a stronger but indefinite band across middle third, veins firm and dark, as preserved the right wing nearly colorless but showing most of the veins, while the left wing is dark with only the costa, radius, and media strong. Anterior branch of radial sector 0.45 mm. long, ending 0.45 from tip of  $R_1$ , posterior branch 1.5 long, ending near apex of wing and 1.2 from tip of anterior branch, base of radial sector 0.45 long, fusion with media 0.3, petiole of media 0.5, m-cu cross vein 0.1, lower distal angle of second basal cell 0.3. Length of hind tibia 2.1 mm., of hind metatarsus 1.3, remainder of tarsus 1.5.

HOLOTYPE: A.M.N.H. No. 26463, from the Miocene shales, Florissant, Colorado, Station 14.

*Proapemon*, Greek, coming before *Apemon* (ἀπήμων, doing no harm); *infernus*, Latin, underground.

## SCIARIDAE

### TABLE OF THE FLORISSANT MIOCENE SPECIES OF *Sciara*

1. Wings infumated, anterior veins brown; thorax piceous, subshining, abdomen light fuscous; legs mostly pale; posterior branch of radius 0.5 mm. longer than the anterior branch.....*requieta*, new species  
Wings hyaline or subhyaline, posterior branch of radius more than 0.5 mm. longer than the anterior branch.....2
2. Length 4.5 mm., wing 3.6,  $R_1$  ending near two-thirds the wing length, ratio of the two branches of radius beyond the apparent cross vein 1:2.17..  
.....*florissantensis* Cockerell  
Wing not over 3 mm. long,  $R_1$  ending nearer middle of wing, the two branches of radius proportioned about 1:2.....3
3. Anterior veins fuscous; legs black; end of abdomen conical.....  
.....*dormitans*, new species  
Anterior veins light brown; legs fuscous; end of abdomen tubular.....  
.....*sopora*, new species

### *Sciara dormitans*, new species

#### Figure 6

FEMALE: Length 4.2 mm.; abdomen 3; wing about 2.7; hind femur 1.3; hind tibia 1.2. Body and legs blackish, the abdominal sclerites slightly less intense, incisures weak. Wings hyaline, anterior veins thin but strong, posterior veins not evident; anterior branch of radius ending about 1.4 mm. from base of wing or 0.95 beyond apparent cross vein, posterior branch extending 0.85 mm. beyond the anterior branch.

HOLOTYPE: A.M.N.H. No. 26464:1, from the Miocene shales, Florissant, Colorado, Station 13.

*Dormitans*, Latin, sleeping, as in death.

***Sciara requieta*, new species**

Figure 7

FEMALE: Length 4.2 mm.; abdomen 2.7; wing 3. Abdomen conical posteriorly, not tubular, front legs very pale, hind tarsi darker than their tibiae. Anterior branch of radius 0.85 mm. long measuring from the apparent cross vein, posterior branch 1.35 from the same place, the straight-line distance between the ends of the two branches 0.9, the anterior branch ending at about 1.65 from the base of the wing and 1.35 from the apex, posterior veins too vague to measure. The wing surface appears to have been hairy, as in the group *Trichosia*.

HOLOTYPE: A.M.N.H. No. 26465, from the Miocene shales at Florissant, Colorado, Station 14.

*Requieta*, Latin, reposed for a long time.

***Sciara sopora*, new species**

Figure 8

FEMALE: Apparently similar to *Sciara florissantensis* Cockerell, but a much smaller species. Length 3.5 mm.; hind femur 1; hind tibia 1.3. Body somewhat shining, abdomen fuscous, lighter in color than the thorax, first five segments measuring about 1.5 mm., the rest of the abdomen forming a protrusile tube 1.2 mm. long. Wings about 3 mm. long, costa and radius firm and light brown, posterior veins indefinite,  $R_1$  ending 0.8 mm. from the apparent cross vein, lower branch of radius extending 1.65 from same point, the straight-line distance between the ends of the two radial branches 0.9, the anterior branch of radius ending at about 1.7 from base of wing and 1.3 from apex.

HOLOTYPE: A.M.N.H. No. 26466, from the Miocene shales, Florissant, Colorado, Station 4.

*Sopora*, Latin, sleeping.

**CHIRONOMIDAE**

KEY TO THE MIOCENE CHIRONOMIDAE FROM FLORISSANT, COLORADO

1. Adults; legs free.....2
- Pupae; thorax with lateral wing pads.....6

2. Body and legs polished black.....*Diamesa extincta*, new species  
Body and legs not or but little polished, lighter in color.....3
3. Male genitalia wider than long, comprising two sturdy, widely encircling  
claspers.....*Chironomus scudderellus* Cockerell  
Male genitalia longer than wide, the claspers relatively narrow and much  
less curved.....4
4. Large, ferruginous species, middle of dorsum castaneous; 7-10 mm.....  
.....*Chironomus primaevus*, new species  
Smaller, not reddish species.....5
5. Thorax brownish, abdomen basally pale, pre-apical segments brownish,  
legs fuscous.....*Chironomus pristinus*, new species  
Thorax and legs piceous, abdomen dark brown, the interstices paler.....  
.....*Chironomus proterus*, new species
6. Abdomen nearly straight, elongate, more than twice the length of thorax  
to end of wing, posterior margins of segments each with long, thin,  
black, chitinous transverse loop...*Chironomus requiescens*, new species  
Abdomen slightly curved down, not over twice the length of thorax to end  
of wings; segments devoid of long setae or loops.....7
7. Insect entirely dull; head inset under front edge of thorax.....  
.....*Chironomus pausatus*, new species  
Insect shining; head extending beyond thorax.....  
.....*Chironomus sepultus*, new species

### ***Diamesa extincta*, new species**

#### Figure 4

Length about 4.2 mm.; length of wing 4 mm. Body and legs polished black. Costa, first and third veins very strong and black, auxiliary and second veins simple and weak, basal cells coextensive on media but second basal cell posteriorly extending beyond first because its cross vein is very oblique, other veins indistinct or wanting, third vein ending just before wing tip and 1 mm. beyond end of first vein, costa continuing to end of third vein.

HOLOTYPE: A.M.N.H. No. 26467, from Florissant, Colorado, Miocene shales.

The species greatly resembles the Holarctic *Diamesa waltlii*, but differs in its shining black color. The antennae and end of abdomen are missing, precluding the determination of the sex of the specimen. This is the only one of some three dozen Chironomidae that shows distinct neurulation. The stone is peculiar, resembling a flattened oval inclusion, the specimen embedded in a thin, smooth, argillaceous layer.

Two shining blackish specimens from the Lacoe collection of the United States National Museum (U.S.N.M. Nos. 112580,

112582) may be assigned here, although they lack wings and are less perfectly fossilized.

*Extincta*, Latin, annihilated.

### ***Chironomus primaevus*, new species**

Figure 15

MALE: Length about 7 mm., the inflexed head 0.6, thorax 1.65, abdomen 5 mm. A dull reddish species, center of mesonotum and lower pleura castaneous, venter and legs somewhat paler, joints of antennae dark; Genitalia slightly longer than wide, oval, measuring 0.4 by 0.55 mm., the forceps gently curved. Wings not discernible.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26469:1, from the Miocene shales, Florissant, Colorado, discovered by William M. Wheeler at Station 13. A topotypic group of three specimens, also found by Wheeler, is represented in obverse and reverse (paratypes A.M.N.H. Nos. 26469:2, 26469:3). Wheeler found another specimen (A.M.N.H. No. 26469:4), slightly larger but less complete, which seems to be the same species.

The assignment of this and the following species to *Chironomus* is intended in a broad sense. Because of the imperfect fossilization of these delicate midges, it is impossible to determine which of the present multitude of genera of the family should include them.

*Primaevus*, Latin, early in life.

### ***Chironomus pristinus*, new species**

MALE: Length 5.6 mm.; head and thorax 1.8, abdomen, 3.8. Head, thorax, and legs fuscous, somewhat shining, joints of antennae paler, abdomen light fuscous on basal half, narrow. As preserved, antennae beautifully feathered, wings indefinite, genitalia narrow but the forceps indistinct. The number of antennal joints cannot be stated, and the tibial structure is uncertain.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26470:1, from the Miocene shales, Florissant, Colorado, Station 14; counter-type: A.M.N.H. No. 26470:1A; paratopotype: A.M.N.H. No. 26470:2.

*Pristinus*, Latin, primitive.

***Chironomus proterus*, new species**

Figures 11, 12

MALE: Length 5.5 mm. A beautiful specimen apparently belongs to the restricted genus *Chironomus*. It lacks wings but has well preserved the plumose antennae. The lengthened front legs have the metatarsi nearly equaling the tibiae. Thorax piceous, abdomen dark brown, the interstices paler.

FEMALE: Length 6.3 mm. Thorax and legs piceous, abdomen brown, the interstices paler. Costal half of left wing as in modern *Chironomus*. Front legs as long as entire body.

TYPE MATERIAL: Holotype: Florissant shales, Miocene, British Museum of Natural History, Department of Geology, No. I. 7359. Allotype (female): Same, No. I. 7358.

*Proterus*, Greek, *πρότερος*, prior.

***Chironomus scudderiellus* Cockerell**

Several specimens from Stations 12 (A.M.N.H. No. 26472), 13 (A.M.N.H. No. 26472/1), and 14 (A.M.N.H. No. 26472/2) seem to belong to Cockerell's species, though the thorax is only brownish and the legs are pale. The original description states that the thorax is "dark" and the legs are ferruginous. Because these midges were too delicate to undergo complete fossilization no taxonomic advantage would follow their separation from the holotype under another species name.

Four individuals of the species are female and show the pair of terminal flaps of the abdomen, which are triangular with bluntly rounded apex. One of the specimens (A.M.N.H. No. 26472:1), here designated the allotype, has the flaps measuring 0.54 mm. long and 0.3 mm. wide at the base.

***Chironomus pausatus*, new species**

Figure 14

Pupa, in side view. Length, not allowing for the slight curvature, 6.5 mm.; thorax 1.9, by 1.5 deep, thorax to end of wing pad 3, abdomen if straightened 5.45. Dull fuscous, thorax and head somewhat darker than the wing pads and abdomen. Eighth segment of abdomen terminated by a pair of small, nearly triangular flaps, which are slightly incurved, rounded at tip and bear hairs but no teeth. These flaps are 0.45 mm. long and 0.2 wide at base and may be lateral rather than dorsoventral,

in case the end of the abdomen is twisted. Wing pads attaining third segment of abdomen, measuring about 2.1 by 0.6 mm. There is no trace of the dorsal respiratory organs.

HOLOTYPE: A.M.N.H. No. 26473, from the Miocene shales, Florissant, Colorado, Station 13.

Although it is possible that the three forms of pupae here described may belong to some of the adults, they have been listed as separate species on the assumption that it is unlikely that adults were flying while their pupae were swimming on the day of extermination.

*Pausatus*, Latin, resting in the grave.

### ***Chironomus requiescens*, new species**

Figure 13

PUPA: Length about 9 mm.; head and thorax 2, depth of thorax 1.75, thorax to end of wing pad 3, abdomen 7.2. Head and thorax almost black, with very little trace of sheen, abdomen light fuscous, last two segments a little darker, incisures colorless. First two abdominal segments with several strong black setae on posterior margin, segments three to seven each having the posterior margin delimited by a thin black chitinous loop, which might have resulted from the fusion of a pair of long cruciate setae transversely infolded. The loops seem to be attached near the posterior corners of the tergites and lie free from the integument. As they are more curved than the incisures, they could not have been formed by a thin but strong induration of the hind margins. Last segment of abdomen apparently with a swimming paddle split medianly.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26474:1, from the Miocene shales, Florissant, Colorado, Station 5, collected by William M. Wheeler. Paratype A.M.N.H. No. 26474:2 was found by Wheeler at the same station. Paratypes A.M.N.H. Nos. 26474/1:1 and 26474/1:2, the latter collected by George Rohwer, are from Station 13; paratypes A.M.N.H. Nos. 26474/2:1 and 26474/2:2 (collected by G. Rohwer), from Station 14. Wheeler made a notation that this was the only dipteron discovered at Station 5. Another specimen (A.M.N.H. No. 26476) represents a similar but probably distinct form. It has long abdominal setae but is smaller, with the abdomen relatively shorter. The thorax to end of wing pads measures about 2.7

mm. and the abdomen about 4.3. The specimen exhibits a leaf-like structure behind the head, probably the base of the respiratory organ.

*Requiescens*, Latin, resting in death.

### **Chironomus sepultus**, new species

PUPA: Lateral aspect. Length from tip to tip, not allowing for the curve of the abdomen, 6.3 mm.; head and thorax 1.65, thorax to end of wing pad 2.8, depth of thorax 1.5, abdomen if straightened 5.6. Body entirely shining, head and thorax in general dark fuscous, abdomen pale fuscous, wing pads concolorous with thorax, showing a large pre-apical spot and the costa black, base of legs and middle of notum and scutellum almost black. Eighth segment of abdomen terminated by an anal plate. Wing pads reaching nearly to middle of third abdominal segment, measuring 2.1 by 0.6 mm. Respiratory organs not indicated.

HOLOTYPE: A.M.N.H. No. 26477, from the Miocene shales, Florissant, Colorado.

This fossil is in a dark gray stratum, obviously different from the light gray clay embedding *pausatus*, which species it resembles in its relatively large thorax and curved abdomen.

*Sepultus*, Latin, destroyed and buried.

## **SCATOPSIDAE**

### **Reichertella fasciata**, new species

Figure 16

FEMALE: Length 3.8 mm. Distinctly pictured on the stone in the usual black color, with no indications of light-colored markings on head, antennae, mouth parts, thorax, and legs. Antennae stout, in length equal to the head. Abdomen showing seven segments, incisures broadly and distinctly marked, the wide abdomen indicating a gravid female. Legs infolded, so the joints not differentiated, all femora stout. Wings hyaline, only the firm blackish anterior veins preserved, first vein ending half-way to the end of the third vein, third vein ending at about seven-eighths the wing length.

HOLOTYPE: U.S.N.M. No. 112563 (R. D. Lacoe collection) from the Miocene shales of Florissant, Colorado.





- Second submarginal cell broader, more than 0.4 mm. at end of branch of third vein.....9
9. First basal cell longer than second by nearly three times length of anterior cross vein; wings strongly infumated anteriorly.....  
.....*Plecia tessella*, new species
- First basal cell longer than second by about twice length of anterior cross vein; wings uniformly brownish.....*Plecia gradata*, new species
10. No anterior cross vein, the submarginal cell fused a short distance with the second basal; femora not clavate.....*Bibiodes intermedia* James
- Anterior cross vein present though reflexed, the submarginal and second basal cells distinctly separated (*Bibio*).....11
11. Anterior cross vein more or less in line with outward continuation of third vein and about as long as base of radial sector or longer.....12
- Anterior cross vein more or less transverse and about one-fourth as long as base of radial sector.....16

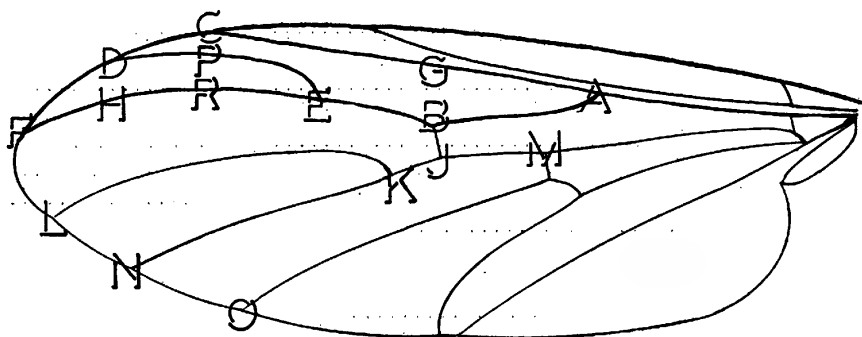


FIG. 1. Generalized neuration of *Plecia* and *Hesperinus*. The lettering indicates points from which measurements are given in table 1.

12. Anterior cross vein much longer than base of radial sector; wings dusky, veins strong; large black species.....*Bibio atavus* Cockerell
- Anterior cross vein somewhat shorter than base of radial sector; wings hyaline, posterior veins weak; species under 10 mm.....13
13. Wings strongly fuliginous; body brown, legs paler.....  
.....*Bibio capnodes*, new species
- Wings clear hyaline.....14
14. Black species.....15
- Reddish species; anterior femora short and thick, hind femora strongly clavate at apex, hind tibiae clavate.....*Bibio vetus* James
15. Hind femora strong, at apical third one-fifth as wide as long.....  
.....*Bibio podager*, new species
- Hind femora relatively slender on basal half, at apical fourth about one-seventh as wide as long.....*Bibio jamesi*, new species
16. Abdomen reddish, contrasting with the blackish thorax; species under 10 mm.....*Bibio cockerelli* James
- Abdomen dark brown or black.....17

17. Abdomen almost unicolorous black or piceous; species under 10 mm... 18  
 Abdominal incisures paler; species over 10 mm..... 19
18. Fourth vein arching forward, the second posterior cell at middle wider than the first posterior..... *Bibio excurvatus*, new species  
 Fourth vein nearly straight, the second posterior cell much narrower than the first posterior..... *Bibio vulcanius*, new species
19. Hind tibiae more slender than femora, only slightly enlarging distally from base, apical width about one-eighth the length.....  
 ..... *Bibio wickhami* Cockerell  
 Hind tibiae almost as broad as their femora, apical width about one-fifth the length; neurulation weak..... *Bibio explanatus*, new species

TABLE 1

WING MEASUREMENTS IN MICRONS OF *Plecia* AND *Hesperinus*, BASED ON FIGURE 1

	<i>axeli- anus</i>	<i>decapi- tata</i>	<i>expla- nata</i>	<i>gradata</i>	<i>immu- tabilis</i>	<i>longi- furca</i>	<i>melan- deri</i>	<i>orycta</i>	<i>tessella</i>
A-B	—	1600	1330	—	900	—	—	1000	1760
A-C	—	—	—	—	2550	2850	—	2600	3270
A-E	2880	2560	2400	—	2300	1770	2015	1400	2970
A-L	—	5000	—	—	—	5000	—	—	—
B-G	480	480	368	510	300	420	290	350	600
B-J	272	—	240	480	300	—	—	300	370
C-D	—	720	—	1060	600	900	—	600	1100
C-F	—	2240	—	2735	1500	2100	—	1650	—
C-P	—	—	—	360	220	270	—	360	300
D-F	1760	—	—	1800	1080	1350	1040	1050	—
D-H	480	368	288	450	270	150	160	250	460
E-D	—	—	800	1650	1050	1840	—	1500	1500
E-F	—	—	2320	3170	1950	3060	—	2500	—
M-J	—	—	—	1000	560	—	—	—	1050
M-K	—	—	1200	1740	—	—	—	—	1620
N-O	—	—	1440	—	—	—	—	—	—
P-R	—	—	—	330	180	160	—	180	340
DH:GB	1.00	0.77	0.78	0.88	0.90	0.36	0.55	0.72	0.77
Wing, mm.	9	8	8×2.9	9×3	6×2.46	8×2.5	6×2.3	6.3×2.1	8×3.25

***Hesperinus axelianus* (Cockerell)**

Four specimens in the Lacoe collection of the United States National Museum are probably this species, originally described as a *Plecia*. The wings of all are imperfectly preserved, thus precluding a positive identification. The specimens are slender, with brownish thorax and legs, the abdomen is mostly yellowish, with the anterior third or so of each segment brownish.

***Hesperinus immutabilis*, new species**

Figure 17

Length 9 mm. Entirely piceous; tibial spurs not apparent; second basal cell complete, truncately closed, and  $560\ \mu$  shorter than first basal, anterior branch of third vein slightly longer than half of posterior branch. Wing 6 mm. long by 2.46 mm. wide, lightly infumated, darker in front, anterior veins strong and dark, third vein apically curving to end at wing tip, entire length of second vein 4.2 mm., second submarginal cell narrow, above 1.05 mm., below 1.95 mm., apically 1.08 mm., width at middle 0.27, media uniformly firm from root of wing, 3 mm. to fork, length of second posterior cell 2.525 mm., first cubitus sharply angulate at apex of second basal cell where it forms a continuous line with the posterior cross vein and then sharply bends to continue midway between the media and the second cubitus.

TYPE MATERIAL: Holotype: U.S.N.M. No. 112554 (Lacoe collection) from the Miocene shales, Florissant, Colorado. Another specimen, U.S.N.M. No. 112588, somewhat smaller, appears to belong here; this paratype is illustrated in figure 17. The species is almost exactly like the existing *Hesperinus brevifrons* Walker.

*Immutabilis*, Latin, unchangeable.

***Hesperinus melanderi* (Cockerell)**

A male measuring 9 mm. but with small wings about 6 mm. long appears to be the same as Cockerell's species, described as a *Plecia*. It compares well with the photographic illustration of the type, but because of its vague neuration its identity cannot be positively assured. R. D. Lacoe collection, U.S.N.M (study number 246).

***Penthetria longifurca*, new species**

Figure 18

FEMALE: Length 9.25 mm. Wholly reddish, the head and pleura darker, legs, abdomen, and wings concolorous, anterior veins fuscous, posterior veins weak and incompletely indicated. Distinct from all the other species in the formation of the second submarginal cell, which is very long and narrow, the branch of the third vein arising in an abrupt curve and then continuing for two-thirds its length midway between the second and third veins

to the end of the second vein and then slightly diverging from the third vein as the latter curves towards the wing tip. Neuration measurements given in the table. Hind legs uniformly slender, the femora and tibiae each 3 mm. long.

HOLOTYPE: U.S.N.M. No. 112551, R. D. Lacoe collection.

***Plecia gradata*, new species**

Figure 19

FEMALE: Length 11.5 mm. Head, thorax, and legs black, abdomen dark brown, the hind margins of the segments narrowly pale, giving the abdomen a scalariform appearance. Wings ruddy brown, the costal area not appreciably darker, veins firm and brown. Neuration measurements given in table. Hind femora not pedunculate, 3 mm. long, clothed with fine short recumbent black hairs.

HOLOTYPE: A.M.N.H. No. 26481, from the Miocene shales of Florissant, Colorado, Station 13; collected by William M. Wheeler in 1906.

***Plecia orycta*, new species**

Figure 21

Length 7.7 mm.; head 0.75, thorax 1.95, abdomen 5.1; wing 6.3 by 1.8 mm. Dorsal view of a fine, wholly black species, with infumated wings, the stigmal area stronger. Neurational measurements as given in the table. Legs slender, front tibiae measuring 2 mm., hind tibiae 2.3 mm.

HOLOTYPE: U.S.N.M. No. 112569 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

*Orycta*, Greek *ὀρυκτή*, dug out of the earth.

***Plecia tessella*, new species**

Figure 20

FEMALE: Length 11 mm. Head and thorax black, legs dark brown, abdomen fuscous, the posterior third of each segment pale; wings gradually paler from the infumated costa, the hind margin nearly colorless, anterior veins firm and brown, posterior veins paler though distinct. Neuration as indicated in table 1. Hind femora and tibiae each 3 mm. long, clothed with fine, short, appressed black hairs.

HOLOTYPE: U.S.N.M. No. 112562 (R. D. Lacoe collection), from the Florissant shales, Miocene.

*Tessella*, Latin, a small square piece of stone.

***Bibio capnodes*, new species**

Figure 30

FEMALE: Length of headless body 9 mm. Body light brown, abdominal incisures indicated by a slightly darker line; legs probably rufous in life. Abdomen very robust, indicating a gravid female. Abdomen and legs furnished with short scattered dark hairs. Anterior legs missing; hind femora gradually somewhat clavate, measuring 3.6 mm., greatest width at distal fourth 0.6 mm., width at base 0.33 mm.; hind tibiae 3 mm. long, width at the nearly truncate apex 0.45 mm., width near base 0.2 mm.; hind metatarsi 1.35 mm. long and 0.2 mm. wide. Wings broad, 8 mm. long by 3 mm. wide at middle, anterior third of wing membrane strongly reddish brown, the anterior veins concolorous and scarcely differentiated, posterior two-thirds of wing similarly though less intensely brown, the veins fuscous and quite distinct, length of basal section of radial sector 0.9 mm., anterior cross vein 0.47 mm. long and strongly reflexed, second posterior cell acute at base.

HOLOTYPE: U.S.N.M. No. 112565 (R. D. Lacoe collection) from the Miocene shales at Florissant, Colorado.

*Capnodes*, Greek *καπνώδης*, as if burnt to ashes.

***Bibio cockerelli* James**

Figures 23, 24

Twenty-one specimens of this moderate-sized species show the blackish thorax and reddish abdomen. Three of these fossils (A.M.N.H. No. 26484) were found at Station 4, three (A.M.N.H. No. 26484/1) at Station 11, and three (A.M.N.H. No. 26484/2) at Station 14. The others are from several accessions of the R. D. Lacoe collection at the United States National Museum, indicating an extended distribution in time for this species.

James described the hind tibiae as clavate with the greatest enlargement apical. The specimens assigned to this species have the hind tibiae rather slender in profile and only slightly but gradually enlarging apically. One specimen, from Station 4, was fossilized so as to show the extensor aspect of the hind leg. Its

tibia appears more clavate, widest before the distal third. This specimen is remarkable in that the wings and abdomen are white in both halves of the stone. A comparison with the holotype of *cockerelli* may show that the new material is different, as suggested by the structure of the hind legs. The anterior cross vein is variable in length, sometimes represented by a knotlike fusion between the third and fourth veins.

***Bibio excurvatus*, new species**

Figure 27

MALE: Length 7.75 mm. A dark species distinguished by having the fourth vein strongly arching so that the second posterior cell at its middle is somewhat broader than the first posterior cell. Head and thorax black, abdomen piceous, the incisures narrowly slightly paler, genitalia stout and black. Wings smoky, especially in front, posterior veins weak though recognizable, stigma not prominent.

HOLOTYPE: U.S.N.M. No. 112550 (Lacoe collection) from the Miocene shales, Florissant, Colorado.

*Excurvatus*, Latin, bending out, i.e., the fourth vein.

***Bibio explanatus*, new species**

Figure 28

FEMALE: Length 11.5 mm. Body and legs black, the abdominal incisures narrowly paler; pubescence not indicated. Front femora short and robust; middle femora fusiform, 1.5 mm. long and 0.45 mm. wide at middle; middle tibiae 1.56 mm. long, uniformly and slightly enlarging, the apex 0.3 mm. wide, the base 0.21 mm.; middle tarsi slender, 2.4 mm. long, the basal joint 1.275 mm. in length; hind femora 3.5 mm. long, definitely clavate, widest 0.9 mm. from the end at which place it measures 0.75 mm.; hind tibiae uniformly expanding almost to the apex, 2.94 mm. long and 0.6 mm. at the pre-apical width; hind tarsi tapering, 2.71 mm. long, the metatarsus 0.975 mm. long and 0.3 mm. wide, the second joint 0.6 mm. long and 0.27 mm. wide. Wings hyaline, anterior veins brownish, posterior veins not distinguishable, neuration difficult to decipher, but the submarginal cell appears almost to touch the discobasal cell at the location of the extremely short anterior cross vein.

HOLOTYPE: A.M.N.H. No. 26485 from the Florissant Mio-

cene shales, Station 11. Both halves of the fossil are represented; the reverse is A.M.N.H. No. 26485A.

*Explanatus*, Latin, flattened out.

***Bibio jamesi*, new species**

Figure 26

MALE: Length 7 mm. Wholly black, the abdominal incisures at most very faintly and narrowly indicated. Upper facets large. Front femora robustly fusiform, greatest width at middle third of their length; hind femora very slender on basal half then clavately swelling but decreasing just before tip, in length 2.55 mm., greatest width 0.45 mm.; hind tibiae 2.4 mm. in length, 0.45 mm. wide at distal fourth, strongly rounding at apex; hind metatarsi 1 mm. long and 0.24 mm. wide. Wings hyaline, anterior veins and stigma very faint, posterior veins indistinguishable.

TYPE MATERIAL: Holotype: A.M.N.H. No. 26486, from the Miocene shales at Florissant, Colorado, Station 4. A.M.N.H. No. 26486A has been assigned to the reverse of the holotype. Two paratypes, U.S.N.M. Nos. 112576 and 112579, have the abdominal incisures concolorous black.

If the interpretation of the anterior cross vein is incorrect, this species would key to *vulcanius*, from which it differs by its weak neurulation, the slender basal half of the hind femora, and the rounding apex of the hind tibiae.

The species is named in recognition of the studies on Florissant Miocene Diptera by Prof. Maurice T. James, as well as for his keen discrimination of existing Diptera.

***Bibio podager*, new species**

Figure 25

MALE: Length 8 mm. Body and legs wholly black, abdominal incisures not paler, pubescence not visible. Head missing. All femora very thick, the front ones measuring 2.1 mm. long and 0.72 mm. wide at middle, the hind femora fusiform, 2.7 mm. long and 0.6 mm. wide at distal third; tibiae imperfect but apparently very stout. Wings nearly hyaline, anterior veins and stigma thin and brown, posterior veins indistinguishable, anterior cross vein in direct line with the third vein, measuring 0.3



mm., the base of the radial sector 0.5 mm., last section of third vein 3 mm.

HOLOTYPE: A.M.N.H. No. 26487 from the Miocene shales at Florissant, Colorado, Station 4. An imperfect female, A.M.N.H. No. 26487/1, measuring 7.5 mm., is apparently the same species.

A female in the National Museum collection, study number 236, has all the femora heavily incrassate, but the abdomen is dark brown instead of carbonized black like the others.

*Podager*, Greek *ποδαγρός*, having swollen legs.

### ***Bibio vetus* James**

One specimen of the Lacoe collection of the National Museum, study number 232, and another, from Station 14, in the American Museum (A.M.N.H. No. 26488) measure 9 mm. and are apparently an all-reddish *Bibio* with strongly clavate hind femora. Because the venation is poorly preserved it cannot be positively stated that they belong to *vetus*, which is characterized by having a relatively long anterior cross vein. Another specimen from the National Museum, number 233, belonging in the first lot, shows the neuration of *vetus*, but the thorax is darker than in the holotype. The hind tibiae are as stout as the femora.

### ***Bibio vulcanius*, new species**

Figure 29

MALE: Length 9 mm. Apparently a wholly black species, although where the carbonization has worn off part of the mesonotum the ground color is shining fuscous. This is not the case on the abraded spots of the legs and abdomen, which are concolorous with the adjacent shale. The part of the fossil bearing the head was destroyed when the stone was first split, and the anterior legs are not preserved. No pubescence is indicated. The incisures of the abdomen are not paler. Hind femora relatively slender, gradually widening on the proximal three-fourths, where the diameter is one-fifth the length. Hind tibiae uniformly widening almost to the truncate tip where the greatest breadth is nearly one-fourth the length. Hind tarsi robust, the metatarsus one-half longer than the second joint. Wings hyaline, anterior veins and stigma very firm and black, posterior veins very weak, second posterior cell sessile, the contact with the discobasal cell equal to the almost transverse anterior cross vein. The following

measurements are in millimeters: length of anterior cross vein 0.15, length of stem of third vein before anterior cross vein 0.51, length of last section of third vein 3, length and greatest width of hind femur 3:0.6, length and greatest width of hind tibia 1.05:0.3.

TYPE MATERIAL: Holotype: U.S.N.M. No. 112564 (Lacoe collection), from the Miocene shales, Florissant, Colorado. A second specimen in obverse and reverse from the same lot (U.S.N.M. No. 112572), measuring about 8 mm., appears to belong here, though obviously from a different stratum. A third specimen (A.M.N.H. No. 26489) represented on both halves of the fossil, from Station 11, is almost certainly the same species as the holotype.

*Vulcanius*, belonging to Vulcan, the god of volcanic fire.

### **Bibio wickhami Cockerell**

Figure 22

This large species was common in the Miocene at Florissant. The American Museum collection contains 10 specimens from Stations 4, 11, 13, and 14 (A.M.N.H. Nos. 26490, 26490/1, 26490/2, and 26490/3, respectively). The United States National Museum has three lots from Lacoe, comprising 12 specimens. Most of the specimens are on a roughened shale and the venation is not distinct. Some have a darkened abdomen, not contrasting with the thorax; in others the abdomen is brownish. The small inner spur of the front tibia, the short anterior cross vein, and the large size characterize this species.

### **STRATIOMYIIDAE**

#### **MOYAMYIA, NEW GENUS**

An incomplete specimen of an enigmatical fly was discovered by William M. Wheeler at Station 14. The bit of shale shows it surrounded by a dozen Chironomidae and Psocidae. Although some taxonomic structures are vague or lacking, enough of the insect is preserved to indicate that the fly is clearly a stratiomyiid, probably in the Clitellariinae, but unlike any genus hitherto recorded. The prominent stigma is entirely distal to the discal cell, and the stout anterior branch of the third vein perpendicularly enters the stigma near its middle. Other Stratiomyiidae have the stigma in front of the discal cell, and the

branch of the third vein, when present, is located beyond the stigma.

Abdomen with six segments; scutellum unarmed; discal cell small and short, seven- or possibly six-sided, third vein heavy, its anterior branch very thick, erect, and extending to the stigma at basal two-fifths, posterior veins evanescent.

GENOTYPE: The following species.

### ***Moyamyia limigena*, new species**

MALE: Length 5 mm.; head about 0.6, thorax 0.2, abdomen 2.4; wing 3. Head and thorax black, abdomen and legs dark castaneous, wings hyaline, veins pale. Discal cell 0.3 by 0.3 mm., anterior cross vein about 0.075 in length, stigma 0.75 long by 0.15 deep near middle, third vein 0.6 between anterior cross vein and fork and 1.2 beyond fork, anterior branch of third vein 0.18 long.

HOLOTYPE: A.M.N.H. No. 26494 from the Florissant Miocene shales, Station 14. Most of the anterior part of the head, including the antennae, is missing, but it seems that the lower face is not protruding. No pile is visible on the eyes or body. The imprint of the insect on the stone is too weak for adequate photographic reproduction.

*Moyamyia*, *moya*, South American, volcanic mud, plus *myia*, Greek, fly. *Limigena*, Latin, produced in pond ooze.

## **RHAGIONIDAE**

### **KEY TO THE FLORISSANT MIOCENE SPECIES**

1. Nearly 20 mm., reddish species with small head, abdomen with paler basal bands..... *Dialysis revelata* Cockerell  
Ten mm. or less..... 2
2. Anal cell closed before margin of wing..... 3  
Anal cell open on margin..... 5
3. Fourth posterior cell closed..... 4  
Fourth posterior cell open..... *Atrichops hesperius* Cockerell
4. Anterior cross vein near base of discal cell..... *Solva moratula* Cockerell  
Anterior cross vein at basal two-fifths of discal cell.....  
..... *Solva inornata*, new species
5. Abdomen not fasciate..... *Symphoromyia subtrita* Cockerell  
Abdominal segments bicolored..... 6
6. Abdomen more blackish than yellow; first basal cell not longer than second..... 7  
Abdomen more yellowish than black; first basal cell somewhat longer than second, fork of third vein before end of discal cell.....  
..... *Rhagio wheeleri*, new species

7. Marginal cell widest at middle and strongly clouded; 9 mm.....  
 .....*Rhagio mystaceaformis* Cockerell  
 Marginal cell widest beyond middle, scarcely darkened; 7 mm.....  
 .....*Rhagio fossitius*, new species

### ***Dialysis revelata* Cockerell**

Figure 34

A specimen of this fine species (A.M.N.H. No. 26495) was discovered by Wheeler at Station 14. Both sides of the stone are pictured, but the neururation is only indistinctly and incompletely preserved. Mouth parts, antennae, and tibial spines are not indicated, but the general habitus is so like modern *Dialysis* that the specimen can well be considered as the same species described by Cockerell in 1908. The small head is distinctive.

### ***Solva (Xylomyia) inornata*, new species**

Figure 33

FEMALE: Length 9.5 mm. Body wholly black, legs apparently yellow except the darkened hind tarsi; abdomen elongate, slender and tapering beyond the fourth segment. Head 1.2 mm. long, thorax 2.1, abdomen 6.2. Annulations of third antennal joint distinct. Wings 6.75 mm. long, nearly hyaline, unmarked, veins firm and dark, second vein ending in line with forking of third vein and apex of discal cell. The following measurements in microns, on straight line between terminal points without allowance for curves: length of second vein 1800, prefurca 1000, anterior cross vein to fork of third vein 1000, anterior branch of third vein 1450, lower side of second submarginal cell 2100, first submarginal cell on costa 1450, second submarginal on costa 1100, discal cell on first basal 600, under side of discal cell 1200, second posterior cell on first posterior 1900, on third posterior 1525, third posterior cell on fourth posterior 1350.

HOLOTYPE: U.S.N.M. No. 112568 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

Cockerell has described *Xylomyia moratula* from Florissant. The neururation of his species is much like that of the European *X. maculata*, Verrall's figure. The present species conforms more closely to the European *X. marginata*, not only in venation but also in the more somber body coloration. The legs are not well enough preserved to indicate the structure of the femora.

**Rhagio fossitius**, new species

Figure 31

Length 7 mm. Head and thorax black, abdomen mostly blackish, sides of basal tergites and posterior third or fourth of the others yellow; body loosely covered with short black hairs; legs pale yellow, the hind tibiae apically and the hind tarsi darkened; wings uniformly but lightly infumated, no stigma, veins brown, the anterior veins well marked though narrow, the posterior veins very delicate. Wings 5 mm. long by 1.95 wide at middle. The following measurements in microns, auxiliary vein ending at 2600, first vein ending 900 farther, second vein ending 450 beyond first vein, anterior branch of third vein arising at angle of 60 degrees and ending just before wing tip, the second submarginal cell 450 at apex and 1450 from end of second vein, prefurca 500, ratio of the three sections of third vein 540:1300:1860, discal cell 1800 long by 450 wide, greatest width of anal cell just beyond middle 540.

HOLOTYPE: U.S.N.M. No. 112626 (R. D. Lacoë collection), from the Miocene shales at Florissant, Colorado.

*Fossitius*, Latin, dug out of the ground.

**Rhagio wheeleri**, new species

Figure 32

FEMALE: Length 9 mm., wing 8 by 2.5 mm. Head black, center of mesonotum and metathorax dark, humeri, sides, pleura, and scutellum yellowish; abdominal segments light colored but each marked with a basal brownish spot becoming transverse on fourth and remaining segments; legs pale, the tarsi brown; wings hyaline, veins light brown, marginal cell widest opposite end of auxiliary vein, branch of third vein ending at apex of wing, 1700  $\mu$  from end of second vein, the branch 2400  $\mu$  long and arising at an angle of 75 degrees, second submarginal cell 650  $\mu$  wide at apex, prefurca 750  $\mu$ , the sections of third vein 700:1150:2400, disca. cell 2100  $\mu$  long by 600 wide at end, the upper side as divided by the cross vein 550:1425, intercalary vein 1260  $\mu$ , last section of fifth vein 990  $\mu$ .

TYPE MATERIAL: Holotype: A.M.N.H. No. 26496:1; graphotype A.M.N.H. No. 26496:2; paratypes A.M.N.H. Nos. 26496:3, 26496:4, 26496:4A; all from the Miocene shales, Florissant, Colorado, collected by William M. Wheeler at Station 14. A

less perfect specimen in the R. D. Lacoe collection (U.S.N.M. No. 112574) appears to be the same, though obviously from a different stratum. The species is very much like the modern *Rhagio vertebratus* Say, but that species has the fork of the third vein beyond the end of the discal cell. *Rhagio wheeleri* is named in commemoration of its discoverer, as a slight token of my profound regard for the late dean of entomologists.

#### NEMESTRINIDAE

There are in the assemblage of Florissant Diptera three specimens of the large and beautiful Nemestrinidae. One from the Lacoe collection is too imperfect for determination. Another, belonging to the British Museum, belongs to *Neorhynchocephalus melanderi* (Cockerell) and is the fifth specimen of this species to be discovered. Part of the head and the apex of the abdomen are lacking, but one wing is complete and shows the neurulation to conform with that of *N. melanderi* as given by Bequaert and Carpenter (1936, Jour. Palaeont., vol. 10, p. 400). No pubescence is visible on the body. (Br.M.N.H. No. I.7383.)

The third specimen (A.M.N.H. No. 26497) is a well-preserved female of *Neorhynchocephalus occultator* (Cockerell), in dorsal view, with the wings outspread, and illustrated as figure 35. It shows the fine pubescent vestiture. The neurulation is weak, but by tilting the stone under the microscope the course of the veins can be traced, exactly like the figure of *occultator* as given by Bequaert and Carpenter.

#### THEREVIDAE

##### ***Nebritus willistoni*, new species**

Figure 36

FEMALE: Length about 6.5 mm.; head 0.9, thorax 2.6, abdomen about 3; wing 4.8. Apparently a reddish insect with testaceous legs and fuliginous wings. Vertex and front flat, nearly horizontal, projecting above and between the antennae, face prominent, cheeks not bulbous; eyes small; antennae porrect, first joint coarctate, 0.42 mm. long and about 0.17 wide at middle, second joint short, third joint but slightly tapering, about 0.54 mm. by 0.12; palpi horizontal, spatulate, provided with hairs. Abdomen furnished with fine pubescence, visible in part. Legs slender. Both wings seem to be distorted and lack

the cross veins and parts of the longitudinal veins, so that distinctive features of the neuration cannot be ascertained. The second submarginal cell seems to be narrow, and the third and fourth veins seem to join apically, as in the Old World genus *Xestomyia*.

HOLOTYPE: U.S.N.M. No. 112553 (R. D. Lacoë collection) from the Miocene shales, Florissant, Colorado.

This species seems to come sufficiently close to the modern Californian *Nebritus pellucidus* Coquillett to be included with it in the same genus. In *pellucidus* the antennae emerge from anterior frontal swellings, while the first antennal joint is longer than the third, is concave above and is set with bristles. The fossil has the long flattened front and greatly swollen basal joint of the antennae, which are the main taxonomic characters setting off *Nebritus*. It also has a pre-apical spot on the third antennal joint, which suggests the peculiar setigerous pit of *Nebritus*. *Tabuda planiceps* also has a horizontal front but has a narrow first antennal joint and the third joint is shortened.

Cockerell has described three fossil Therevidae from Florissant, all of which are entirely different from the present form.

I have selected the species name in appreciative memory of my early mentor, Samuel Wendell Williston, who first acquainted me with the Florissant Diptera and whose instructive suggestions about insect phylogeny have been a continual inspiration in my taxonomic studies.

### BOMBYLIIDAE

#### TABLE OF THE SPECIES OF *Alepidophora* COCKERELL

1. Branch of third vein nearly paralleling the bulbous end of marginal cell. . . . . *pealei* Cockerell  
 Branch of third vein diverging from the recurved end of the second vein, so that the costal distance between them is much greater than the diameter of the first submarginal cell at the bulb. . . . . 2
2. Third posterior cell scarcely narrowed apically, almost as wide on the wing margin as the second posterior cell. . . . . *minor*, new species  
 Third posterior cell noticeably narrowed apically, about half as wide on the margin as the second posterior cell. . . . . *cockerelli*, new species

#### *Alepidophora minor*, new species

Figure 39

FEMALE: Length 6.75 mm.; wing, 6.35 by 2.2; head and thorax, 2.94; abdomen, 3.81 by 1.95 mm. Head and thorax black, abdomen dark brown, with wide colorless membranous

spaces between the sclerites, possibly because of its gravid condition; coxae and legs light fuscous; wings hyaline, veins brown, neuration essentially as described by Cockerell for the genotype.

HOLOTYPE: A.M.N.H. No. 26498, from the Miocene shales at Florissant, Colorado, Station 13.

The species is very much like *A. pealei* Cockerell, described in 1909, but its body is only about half the size, while the wings are nearly as long as in that species. The patches of hairs of the abdomen are not visible.

***Alepidophora cockerelli*, new species**

Figure 40

MALE: Length 9.25 mm.; wing almost 6 by 1.8; head and thorax to end of scutellum 3.375; abdomen 6.6 by 2.55 mm. Head and thorax black, abdomen fuscous, with wide, colorless, transverse spaces between the sclerites, genitalia globular and blackish. Sides of thorax above root of wing and scutellum with several black bristles, posterior margin of tergites with a row of black setulae. Legs blackish. Wings hyaline, veins light brown, third and fourth veins divergent at anterior cross vein to end of discal cell, then converging. The following wing measurements are in microns: prefurca 250, anterior cross vein 180, third vein from prefurca to anterior cross vein 1700, discal cell on first basal 1450, on second basal 300, on first posterior 500, on second posterior 240, on third posterior 750, the cross vein proximally arched and then straight and parallel with hind margin, discal cell on fourth posterior 800, length of second basal cell 1350, second basal on fourth posterior 150, third posterior on second posterior 600, on fourth posterior 790, on margin 300, marginal width of first posterior cell 125, of second posterior 750, of anal cell 125, width of anal cell at middle 300.

HOLOTYPE AND COUNTERTYPE: A.M.N.H. Nos. 26499, 26499A, from the Miocene shales, Florissant, Colorado, at Station 14.

I am happy to dedicate this fine insect in memory of the late Theodore Dru Alison Cockerell, the versatile proponent of the Florissant Tertiary insects.

***Amphicosmus delicatulus*, new species**

Figure 37

MALE: Three submarginal cells present, second vein greatly reflexed at end, the marginal cell apically bulbous, four posterior



cells all open, anal cell open; abdomen slender. Head and thorax 2 mm., abdomen 2.85; wings 3.3 by 1 mm. Head and thorax fuscous, abdomen yellow, the globular genitalia brownish, hind femora fuscous, the tibiae paler; wings clear hyaline, veins brownish, no stigma, posterior veins very weak, first vein fusing with costa along middle third of wing, width of bulbous end of marginal cell  $240\ \mu$ , the inner corner at end of second vein 100 degrees, length of second submarginal cell along third vein  $900\ \mu$ , the branch vein sinuous, prefurca  $200\ \mu$ , third vein between prefurca and fork 1350, length of first basal cell 1650, of second basal cell 800, discal cell on first basal 660, on first posterior 400, discal on third posterior 500, the bounding vein proximally arched, greatest width at middle of anal cell 150, width at apex 60. •

HOLOTYPE AND COUNTERTYPE: A.M.N.H. Nos. 26600, 26600A, from the Miocene shales at Station 11, Florissant, Colorado, S. A. Rohwer, collector.

Although the cross vein leading from the second submarginal to the bulbous end of the marginal cell is but vaguely indicated, I believe it was normally present. If I am mistaken in detecting this cross vein the species is to be located near *Paracosmus*. The venation corresponds with *Amphicosmus cincturus*, as figured by Williston and by Curran, but the extreme base of the second submarginal cell is narrower.

### ***Protophthiria atra*, new species**

Figure 38

FEMALE: Length 7.5 mm. Body uniformly blackish; vestiture, if any, not preserved; wings hyaline. Face short; basal joint of antennae stout, cylindrical, square in profile, hairy above, the second joint small, the third joint 2.5 times as long as deep, widest just before middle, then uniformly tapering to the blunt apex; proboscis apparently inflexed and more than twice the head height. Wings immaculate, no stigma, veins thin but firm, blackish, first basal cell longer than second by nearly length of anterior cross vein, contact of second basal with discal cell  $400\ \mu$ , with fourth posterior cell  $450\ \mu$ ; pedicel of third vein equaling last section, the anterior branch widely arching at base, anterior cross vein nearly perpendicular and located  $600\ \mu$  from base of discal cell

and 1200 from apex, on third vein the anterior cross vein is 910  $\mu$  from junction of second vein and 1840 from submarginal fork; first posterior cell widely open, width of second posterior cell at base equal to anterior cross vein; vein between discal and third posterior cell parallel with margin, sides of third posterior cell not converging; anal cell closed before margin, but short-petiolate.

HOLOTYPE: U.S.N.M. No. 112552 (Lacoe collection), from the Miocene shales, Florissant, Colorado.

The species is larger than most phthirias and differs in having the anterior cross vein placed much before the middle of the discal cell and in having a relatively short second submarginal cell. Present-day phthirias have the anterior cross vein located at or beyond the middle of the discal cell, and the furcation of the third vein is opposite the posterior cross vein. The fossil differs from *Protophthiria palpalis* Cockerell, also from Florissant, in its shorter abdomen, longer proboscis (if the interpretation is correct that the pendant structure under the head is the proboscis and not part of the front leg), enlarged basal joint of the antennae, proximal placement of the anterior cross vein, and distinctly larger second basal cell. The species is more robust than *Lithocosmus*, with which it agrees in the proximal location of the anterior cross vein, but that genus is excluded from the Phthiriinae by having a distinct spiniform process terminating the antennae.

### ***Apolysis magister* Melander**

Figure 42

*Apolysis magister* MELANDER, 1947 (Sept.-Dec. 1946), *Psyche*, vol. 53, p. 47, pl. 2, fig. 3.

A beautiful specimen from Florissant, U.S.N.M. No. 112573 (Lacoe collection), is the fossil designated as paratype in the original description. The posterior veins are not definitely indicated, but the discal cell appears to be open as in *Apolysis*. The proboscis extends straight forward and, when uncovered after the photograph was made, projects more than twice the head height. The antennae are blunt, and the third joint is almost cylindrical, slightly widened just beyond the middle. The branch of the third vein ends just before the tip of the wing; the last two sections of the third vein are equal.

**Melanderella testea**, new species

Figure 41

Length 9.5 mm. Black; abdomen narrow and parallel sided, more than twice as long as head and thorax together, measuring 6.75 mm., the segments narrowly fasciate on the hind margins, the pale bands occupying about one-sixth the segments, posterior lateral corners of the basal three segments not well chitinized so the fossil appears to have the anterior angles lobate, as in the species of *Pachysystropus*. Legs mostly pale, hind knees and tibiae fuscous, hind femora incrassate and finely pubescent, hind tibiae infolded against the femora. Wings long and narrow, without alula, measuring 4950  $\mu$  long by 1200 wide, nearly hyaline, veins fuscous, length of auxiliary vein 1800  $\mu$ , of first vein 2550, prefurca short, 150  $\mu$ , second vein beyond prefurca 3000, upper branch of third vein 1350, not elbowed nor appendiculate, width of second submarginal cell on marginal 500, third vein gently curving away from second to end well beyond wing tip, end of fourth vein not preserved, width of first basal cell at base of discal cell 140, anterior cross vein 700 from base of discal cell, length of second basal cell 1300, apical width of second basal 240, anal cell on third posterior cell 560. Knob of halteres black, unexpectedly well preserved, chitinized as in the Systropodinae.

HOLOTYPE: U.S.N.M. No. 112553 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

*Testea*; Latin, made of baked earth.

The legs of modern Bombyliidae are slender, adapted for alighting and not for walking. Two of the Florissant genera of Systropodinae have the hind femora incrassate. In *Pachysystropus* the first posterior cell is closed; in *Melanderella* this cell is open. Unfortunately the present specimen does not show the condition of the apex of the fourth vein, but because of the slight curvature of the anterior branch of the third vein the species has been placed in *Melanderella*. *Pachysystropus condemnatus* has the branch of the third vein strongly sinuous; *P. rohweri* has it elbowed and appendiculate.

TABLE OF THE SPECIES OF *Melanderella* COCKERELL

Wings longer than abdomen; abdomen less than twice as long as head and thorax together.....	<i>glossalis</i> Cockerell
Wings shorter than abdomen; abdomen more than twice as long as head and thorax together.....	<i>testea</i> , new species

## ASILIDAE

*Senoprosopis eureka*, new species

Figure 43

Wing 13 by 3 mm., brownish yellow, long and slender, narrowed at tip, anal lobe small, alula reduced. Marginal cell closed and short-petiolate, two submarginal cells, five posterior cells, second submarginal cell one-third longer than its pedicel, fourth posterior and anal cells closed and short-petiolate, second basal and fourth posterior cells in contact in a point, discal cell very narrow, the under side scarcely angulate at junction of  $M_3$ , anterior cross vein beyond middle of discal cell, auxiliary vein entering costa at middle of wing, second vein forking just before base of discal cell, the prefurca long,  $M_3$  arising midway between the cross veins, curving, but in general parallel with the posterior cross vein. The following measurements are in millimeters: petiole of marginal cell 0.57, of second submarginal cell 2, radial sector 1.65, upper branch of third vein 3.75, sections of upper side of discal cell 2.25:1.2, of lower side 2.5:0.66, upper side of second posterior cell 3, of lower side 1.65, third posterior cell on wing margin 2.4, fourth posterior cell on wing margin 1.35.

HOLOTYPE AND REVERSE: A.M.N.H. Nos. 26602, 26602A, from the Miocene shales at Florissant, Colorado, Station 14.

*Eureka*, Greek, *εὐρηκα*, I have made an unexpected discovery!

This fly, represented by one wing attached to a bit of the body, is difficult of exact placement. The lack of head and legs prevents comparison with the majority of genera, but by a process of elimination the insect finds proper location in the Asilidae. The slender wing, with reduced anal field and small alula, a narrow discal cell, closed marginal, fourth posterior and anal cells, narrow second submarginal cell with the anterior branch of the third vein ending at the wing tip, and especially the absence of the small cross vein between the second basal and fourth posterior cells place the insect in the subfamily Asilinae.

The genera of Asilinae are differentiated largely on other characters than venation, therefore the positive generic location of the fossil must await the discovery of a more complete specimen. The wing agrees well enough with modern species of *Senoprosopis* to admit placement in that genus. The second submarginal cell is not lyriform as in *S. arizonensis* Williston, and the fourth posterior cell is closed farther from the margin than in

the New Zealand *S. meridionalis* Hutton, the two species I have for comparison, but these are not generic distinctions.

James has recently described *Senoprosopis antiquus*, also from Florissant, in which the second submarginal cell is more than twice as long as its petiole.

*Senoprosopis* was established by Macquart in 1838 for an Indian species. Since then it has been found to have a wide distribution, as two species have been reported from New Zealand, four from Brazil, and one from Arizona. Macquart selected his generic name in reference to the very narrow face. Williston, 1893, corrected the orthography to *Stenoprosopus*, and this spelling was accepted by Aldrich in his "Catalogue." In Kertész' "Catalogus" the name is given as *Stenoprosopis*. That the original spelling was not a typographical mistake is evident from Macquart's use of *Senoprosope* or *Senoprosopis* five times in the "Diptères exotiques," as well as erecting the genera *Senobasis*, *Senogaster*, *Senometopia*, *Senopterina*, *Senotainia*, and *Senoxericera*. *Seno-* evidently was Macquart's predilection for στενο-.

## EMPIDIDAE

### KEY TO THE MIOCENE EMPIDIDAE OF FLORISSANT

1. Third vein forked.....2  
Third vein simple.....7
2. Abdomen much longer than basal width; proboscis longer than head....3  
Abdomen short and broad; proboscis shorter than head; intercalary vein abbreviated.....*Progloma rohweri* James
3. Proboscis porrect; discal section of fifth vein very short.....  
.....*Acallomyia probolaea*, new species  
Proboscis inflexed (*Empis*).....4
4. Length over 7 mm.....5  
Less than 6 mm. in length.....6
5. Branch of third vein ending close to end of second vein.....  
.....*Empis perdita* Cockerell  
Branch of third vein ending about midway between ends of second and third veins.....*Empis infossa*, new species
6. Last section of third vein subequal to branch; robust, 5.5 mm. long, hind femora stout.....*Empis miocenica* Cockerell  
Last section of third vein about two times length of branch; less robust, 4.5 mm. long.....*Empis florissantana* Cockerell
7. Discal and second basal cells separated, four posterior cells (*Rhamphomyia*).....8  
Discal and second basal cells united, three posterior cells; front femora thickened.....*Tachypeza primitiva*, new species

8. Prefurca short and strongly curved, anterior cross vein beyond basal third of discal cell and not exceeding  $176\ \mu$  in length. ....9  
     Prefurca longer and gently curved. ....10
9. Apical distance between second and third veins more than twice that between third and fourth veins. ....*Rhamphomyia hypolitha* Cockerell  
     Apical distance between second and third veins less than twice that between third and fourth veins; abdomen with many coarse hairs. ....  
     .....*Rhamphomyia aeterna*, new species
10. Body pale, or abdomen much paler than thorax. ....11  
     Thorax and abdomen blackish. ....15
11. Abdominal segments with posterior fringe of hairs; hind femora closely setose beneath; wings hyaline (male). ....  
     .....*Rhamphomyia tumulata*, new species  
     Not of this combination of characters. ....12
12. Hind tibiae of female not squamose. ....13  
     Hind tibiae of female heavily fringed on both edges with black scales; thorax blackish. ....*Rhamphomyia interita*, new species
13. Thorax black. ....14  
     Thorax pale, with strong bristles; wings wide, pale flavescent, third vein greatly sinuous. ....*Rhamphomyia craterae*, new species
14. Wings hyaline, discal cell one-third the length of the wing. ....  
     .....*Rhamphomyia spodites*, new species  
     Wings brownish, discal cell one-seventh the length of the wing. ....  
     .....*Rhamphomyia sepulta* Cockerell
15. Length 7.8 mm.; body and legs with numerous setae; discal cell short and wide. ....*Rhamphomyia inanimata*, new species  
     Smaller species. ....16
16. Hind tibiae widely compressed and shaggy. ....  
     .....*Rhamphomyia infernalis*, new species  
     Legs simple, body and legs virtually bare, the sparse hairs short. ....17
17. Wings infumated. ....*Rhamphomyia fossa*, new species  
     Wings hyaline. ....18
18. Venter pale. ....*Rhamphomyia morticina*, new species  
     Venter black. ....*Rhamphomyia senecta*, new species

### ***Acallomyia probolaea*, new species**

Figure 45

**FEMALE:** Length 4.7 mm.; head 0.5, thorax 1.2, abdomen 3 mm. Body and legs wholly black, the abdomen as fossilized iridescent dark brown, paler than the legs. Antennae elongate, 0.6 mm. long, the first joint longer than the second, the third narrowly lanceolate, 0.21 mm. long, style measuring 0.125 mm.; proboscis sturdy, projecting straight forward 1 mm. beyond mouth opening. Metapleural setulae present. Legs slender, simple, hind femora 1.5 mm. long, hind tibiae 1.4 mm., with two apical setae, hind tarsi slender, 0.7 mm.; the sole with small stiff

hairs. Wings nearly hyaline, 3 mm. long by 1.2 mm. wide, veins fuscous, thin but firm, stigma obvious, filling end of marginal cell, basal cells short and coëxtensive, discal cell 0.75 mm. long by 0.25 wide, auxiliary vein parallel with first vein and evanescent midway the costal cell, first vein ending 1.2 mm. before level of wing tip, second vein ending 0.7 mm. beyond first vein, third vein recurved towards apex, ending at wing tip 0.7 mm. beyond second vein, its branch 0.3 and last section 0.55 mm., sections of fourth vein 0.2:0.55:1.45 mm., discal cell on second posterior 0.09, on third posterior 0.375, on fourth posterior cell 0.24 mm.

HOLOTYPE: A.M.N.H. No. 26603 from the Miocene shales, Florissant, Colorado, Station 14.

The neurulation is almost exactly as in the recent *Acallomyia brunnea* (Coquillett), but the proboscis is much stouter and is stretched straight forward instead of pendant at an angle of about 45 degrees. The stiff projecting proboscis is suggestive of *Iteaphila*, but the small discal cell, steeply inclined posterior cross vein at the base of the third posterior cell, and presence of a group of metapleural hairs preclude relationship with that genus.

*Probolaea*, from Greek *προβόλαιος*, a spear held out before one.

### ***Empis infossa*, new species**

Figure 49

FEMALE: Length 7.8 mm.; head 1 mm., thorax 1.35, abdomen 5.45. In dorsal view, apparently a dark species of normal build, with blackish legs and lightly infumated wings. Antennae elongate and slender. Body hairs not apparent; abdomen ending bluntly, two terminal styles visible. Legs simple, no bristles visible except the apical spurs of the tibiae, hairs microscopic; front femora measuring 1.4 mm. by 0.27 at middle, middle femora 1.35 mm. by 0.25, hind femora 2 mm. by 0.27; front tibiae 1.8 mm. by 0.12 at tip, middle tibiae 1.35 by 0.18, hind tibiae 2.15 by 0.2. Wings 6.2 mm. long, veins dark, stigma not indicated, second vein ending 2.5 mm. from fork with third, branch of third vein 1.4 mm. long.

HOLOTYPE: U.S.N.M. No. 112625 (R. D. Lacoe collection), from the Miocene, Florissant, Colorado.

The apical part of the left wing is apparently distorted so that there is an angulation in the third vein near the basal third of the first submarginal cell, the distal part then directed forward more

than normal to collapse the second submarginal cell to a narrow wedge. The apical part of the right wing is not well enough preserved for checking.

*Infossa*, Latin, buried in the earth.

***Rhamphomyia aeterna*, new species**

Figure 46

MALE: Length 6.4 mm.; head and thorax 2.8, abdomen 3.6; wing 4.5. Head and thorax black, abdomen dark brown, furnished with coarse black hairs which are especially prominent before the incisures where the hairs are one-third as long as the segments. Genitalia small and round in dorsal view, showing two arcuate blunt opposing valves 0.5 mm. long by 0.2 wide. Legs dark brown, with many short coarse hairs, under side of middle tibiae with a fringe of about 18 setae. Wings subhyaline, veins brown, prefurca very short and strongly curved, anal angle full, axillar excision broad and shallow. The following measurements are in microns: prefurca 120, distance between ends of second and third veins 810, the third vein gently curving to end at wing tip, apex of first posterior cell 550, of second posterior cell 525, sections of discal cell 330:540, the anterior cross vein opposite tip of second basal cell, discal cell on second posterior cell 110, on third posterior 460, on fourth posterior 320, on second basal cell 450.

HOLOTYPE: A.M.N.H. No. 26604, from the Miocene shales, Florissant, Colorado, Station 14.

The species seems to be very close to *Rhamphomyia hypolitha* Cockerell from the same locality but differs in the course of the third vein which swings closer to the second vein than in Cockerell's species.

*Aeterna*, Latin, everlasting.

***Rhamphomyia craterae*, new species**

Figure 54

FEMALE: Length about 8 mm.; head 1, thorax 2.3, abdomen about 4.6; wing 4.8 by 2.2. A pale-colored species, probably testaceous in life. Antennae slender, base setulose, 0.75 mm. long, proboscis nearly three times the head height. Thorax with strong setae, i.e., humeral, notopleural, intra-alar, postalar, and six dorsocentrals. Abdominal hairs small and scattered. Legs coarsely hairy, simple, coxae setose, hind femora with some



setae beneath, hind tibiae with at least one extensor seta at three-fifths. Wings with slight flavescent tinge, a little stronger around end of costal cell, the costa and first and third veins strong, light fuscous, the other veins weak; in microns the width of the marginal cell at end of first vein 200, width of submarginal cell at end of first vein 450, at end of second vein 500, first vein ending 2000 from level of wing tip, costal distance between first and second veins 900, straight line distance between end of second vein and the recurved end of third vein 1300.

HOLOTYPE: U.S.N.M. No. 112561 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

Easily recognized by its relatively sigmoid third vein.

*Craterae*, Latin, of a volcano.

### ***Rhamphomyia fossa*, new species**

Figures 51, 57

FEMALE: Length about 5.5 mm.; head 0.65, thorax 1.5, abdomen 3.4; wing 3.6 mm. Entirely black except the abdominal incisures and venter. Antennae with third joint lanceolate, 0.35 mm. long by 0.1 at base; proboscis slightly longer than height of head. Abdomen with the apical stylets developed. Legs simple, without evident bristles, hind tibiae 1.8 mm. long, scarcely thickened apically, tarsi slender. Wings moderately infumated, anterior veins fuscous, posterior veins very weak, stigma faint, third vein ending at tip of wing.

MALE: Enough like the female to be considered the same species. Genitalia forming a compact globular ending to the abdomen. Legs slender and simple.

TYPE MATERIAL: Holotype, female, U.S.N.M. No. 112567 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado. Allotype, male, U.S.N.M. No. 112583, also from the Lacoe collection but bearing a different accessions number so possibly from another station.

The wings of both specimens overlap and thus preclude an analysis of the neuration.

*Fossa*, Latin, dug out.

### ***Rhamphomyia inanimata*, new species**

Figure 56

MALE: Length 7.8 mm.; head 0.75, thorax 2.25, abdomen 4.8; wing 4.8 by 1.8. Body and legs shining black. Antennae

with the third joint elongate lanceolate, 0.6 mm. long; proboscis at least one and a half times the height of head. Incisures of abdomen pale, hind margins of segments with full series of long setae, which measure about half the length of the integument, other hairs rather coarse; pygidium small, globular, not enlarging end of abdomen. Legs not abnormal, hind tibiae 2.25 mm. long, slightly and uniformly widening towards tip, with numerous extensor setae, the flexor surface closely setulose, hind metatarsi nearly as strong as the tibiae, 1.05 mm. long, with closely setulose sole. Wings moderately infumated, the basal half paler, darker along the stigma, veins fuscous. The following measurements are in microns: distance between ends of first and second veins 1050, between ends of second and third veins 1000, width of marginal cell at end of first vein 200, of submarginal cell 270, discal cell 1000 by 520, discal on first basal 325, on first posterior cell 675, on second posterior 150, on third posterior 480 and curved, on fourth posterior 400, on second basal 400, second vein strong, perpendicular width of submarginal cell at end of second vein 375, third vein gently curved and ending at wing tip, sections of fifth vein 400:1140, perpendicular width of first posterior cell opposite end of second vein 450.

HOLOTYPE: U.S.N.M. No. 112570 (countertype, U.S.N.M. No. 112586), R. D. Lacoe collection, from the Miocene shales, Florissant, Colorado.

*Inanimata*, Latin, lifeless.

### ***Rhamphomyia infernalis*, new species**

Figure 47

FEMALE: Length about 4.75 mm. A black species with enlarged hind tibiae. Occiput bristly; third antennal joint elongate and slender; proboscis at least as long as head. Vestiture of abdomen rather coarse, especially along posterior margins of segments. Anterior legs simple, no bristles visible on femora or tibiae but front coxae with hairs on anterior face, all femora with coarse short hairs, hind tibiae 1.8 mm. long by 0.3 wide including the fringe, the extensor edge with close narrow scales, hind metatarsi robust, 1 mm. long by 0.2 wide. Wings about 3 mm. long, subhyaline, anterior veins strong, posterior veins weak, stigma elongate.

HOLOTYPE: U.S.N.M. No. 112556 (R. D. Lacoe collection), from the Miocene shales, Florissant, Colorado.

There is a streak on the stone suggestive of a greatly reflexed branch of the third vein. As this is bent beyond the perpendicular it probably is extraneous and should not remove the species from *Rhamphomyia*. The tip of the other wing is defective, so the structure cannot be checked.

*Infernalis*, Latin, belonging to the regions below the earth's surface.

### ***Rhamphomyia interita*, new species**

Figure 58

FEMALE: Length 6.75 mm.; head 0.75, thorax 2.1, abdomen 3.9; wing 4.2. Proboscis one-third longer than head height, inflexed. Thoracic bristles not evident, but at least two small scutellars. Abdomen paler than thorax, five incisures distinct, segments 6, 7, and 8 forming a widely conical and chitinized tip, vestiture consisting of scattered short black hairs. Anterior legs slender, coxae and femora fuscous, tibiae and tarsi blackish, hind femora moderately strong, progressively darker towards knee, the hairs fine and short, hind tibiae compressed, both edges strongly squamose, the fringes equal to the diameter of the tibia, hind metatarsi robust, about half as long as their tibiae, apparently not squamose. Wings probably hyaline, veins probably testaceous, weak, third vein ending before wing tip, simple.

HOLOTYPE: A.M.N.H. No. 26605, collected from the Miocene shales, Florissant, Colorado, at Station 14, by William M. Wheeler.

*Interita*, Latin, perished.

### ***Rhamphomyia morticina*, new species**

Figures 50, 52

MALE: Length 6.5 mm. Piceous black, venter and incisures of abdomen paler. Antennae slender, about 720  $\mu$  in length, third joint lanceolate, three times as long as greatest width and slightly more than twice as long as the style; proboscis one-third longer than height of head. Costa and first, second, and third veins strong, the other veins weak, third vein ending at wing tip, costal sections proportioned 5:3:2, discal cell relatively short and wide, measuring 820  $\mu$  in length and 400 in width. Abdominal hairs sparse, short, and black; pygidium moderately large, somewhat higher than preceding segment, globular, valves

and penis not indicated. Legs strong, not villose, front metatarsi fully as wide as their tibiae.

FEMALE: Differs in having more slender legs, the front metatarsi not at all thickened. Antennae, proboscis, thorax, and abdomen as in the male. Wings apparently broad. Legs not scaled.

Types in the British Museum of Natural History, Department of Geology, Nos. I.7361 and I.7362, the male marked with study number 194, and the female 191. Miocene shales, Florissant, Colorado.

*Morticina*, Latin, of an animal that has died.

### **Rhamphomyia senecta**, new species

Figure 53

MALE: Length about 6 mm.; head wanting, thorax 1.5 mm., abdomen 3.9. Wholly black, dorsum of thorax as preserved with some small but firm bristles. Abdomen with the incisures narrowly pale, vestiture consisting of sparse and short hairs, even along posterior margins of the segments; pygidium not larger than end of abdomen. Legs slender, hairs minute, no evident setae, but some very small bristles present under hind femora. Wings nearly hyaline, overlapping in the specimen so the neuration is confused, all veins fuscous, no stigma.

HOLOTYPE: A.M.N.H. No. 26606, collected by Sievert A. Rohwer from the Miocene shales, Florissant, Colorado.

This species resembles *Rhamphomyia morticina*, but has a smaller pygidium, and apparently the discal cell is longer and narrower.

*Senecta*, Latin, very old.

### **Rhamphomyia spodites**, new species

Figure 55

MALE: Length about 5.75 mm., the head and anterior portion of the thorax missing, abdomen 3 mm. Thorax blackish, abdomen pallid, provided with a few loose fine hairs along posterior margins of the segments and with scattered hairs. Anterior legs blackish, hind femora and tibiae yellowish, of normal structure, no bristles visible, hind tibiae and metatarsi very slender, the tibiae 1.35 mm. long. Wing about 4.5 mm., nearly hyaline, veins pale fuscous, thin. The following measurements are in

microns: discal cell 1500 long, level of humeral cross vein to separation of second and third veins 600, end of second vein to end of third about 800, discal cell on first posterior cell 900, on second posterior cell 150, on third posterior cell 360, on first basal cell 550.

HOLOTYPE: A.M.N.H. No. 26607, from the Miocene shales, Florissant, Colorado, Station 14.

*Spodites*, Greek σποδῖτης, baked in ashes.

### ***Rhamphomyia tumulata*, new species**

Figure 48

MALE: Length 6.1 mm.; head 0.55, thorax 1.85, abdomen 3.75; wing 3.8. Head, thorax, and legs blackish, abdomen nearly colorless but with a narrow middorsal basal dark stripe extending halfway to the light fuscous globular genitalia. Chaetotaxy of head and thorax not evident, but abdomen with scattered, rather long black hairs which become definitely long as they fringe the posterior borders of the segments. Legs not abnormal, rather slender, the hind femora beneath with a close row of about 22 setae and the hind tibiae finely setulose underneath. Third antennal joint lanceolate; proboscis short, scarcely longer than height of head. Wings nearly hyaline, possibly in life with a slight flavescent tinge, veins light brown, third vein gently curving to wing tip.

HOLOTYPE: A.M.N.H. No. 26608, collected by William M. Wheeler from the Miocene shales, Florissant, Colorado, Station 14.

When first uncovered the insect appeared to have remarkable porrect palpi. However, the structure is extraneous, possibly part of a spider's leg.

*Tumulata*, Latin, entombed.

### ***Tachypeza primitiva*, new species**

Figure 59

MALE: Length 7 mm.; head 0.75, thorax 1.8, abdomen 4.5. Head and thorax black, abdomen dark brown, the pale incisures prominent, genitalia blunt. Posterior legs simple, the femora yellowish, tibiae and tarsi progressively blackened, front legs raptorial and blackish, front coxae long and strong, 0.9 mm. in length, front femora robust, 1.2 mm. in length. Wings narrow,

about 5 by 1.45 mm., veins thick and blackish on the dark portion of the wing, approximately the apical half infumated, the picture extending from the end of the costal cell diagonally across the fork of the second and third veins, second vein 1.5 mm. long, prefurca 1.2, anterior cross vein 0.25, located 0.15 beyond the fork of the second and third veins, distance between ends of first and second veins 0.7, between second and third veins 0.75, between third and fourth veins 0.3.

HOLOTYPE: U.S.N.M. No. 112566 (R. D. Lacoe collection), from the Miocene shales at Florissant, Colorado.

*Primitiva*, Latin, the earliest of its kind.

### SYRPHIDAE

#### *Platycheirus lethaeus*, new species

Figure 44

FEMALE: Length 7 mm. Head and thorax including scutellum wholly black (the shining carbonization abraded on much of the mesonotum), abdomen with broad yellow fasciae, hind legs black, middle femora brown. Head parts crushed, with only the distorted base of the black antennae visible. Scutellum semi-circular. Abdomen narrowly ovate, first segment wholly black, second segment black on posterior two-fifths, in front of which the large quadrate corners are yellow and the middle portion is black and tapers slightly to its junction with the posterior band; third segment widest, yellow on anterior three-fifths, black behind, with an indication of a median dark stripe; fourth segment similar to third, the yellow portion a little more extensive; fifth and sixth segments yellowish. Wings clear hyaline, 5.5 mm. long, anterior cross vein slightly inclined, located 0.5 mm. beyond base of discal cell.

HOLOTYPE: Miocene shales, Florissant, Colorado, discovered by Junius Henderson and Francis Ramaley at the northwest corner of Fossil Stump Hill (University of Colorado No. 19899).

As the specimen is a female it is impossible to state with certainty that it is a *Platycheirus*, since the genus is based on peculiarities of the legs of the males. However, the broad yellow markings of the abdomen are more like those of modern females of *Platycheirus* than conforming to the pattern of *Melanostoma*, where the pale spots tend to become triangular. A specimen from Station 14, discovered by S. A. Rohwer (A.M.N.H. No.

26610), appears to belong here. It is exposed in ventral view. A bit of the front or middle tarsus is seen to be widened. The hind femora are black. The abdomen is somewhat broader than in the type but presents the same color pattern, with the fifth segment brownish, the sixth segment not visible.

*Lethaeus*, Latin, belonging to the lower regions of the earth.

## PHORIDAE

### *Phora laminarum* Brues

Figure 61

MALE: Length about 3.5 mm.; head 0.45, thorax 1.1, abdomen 2 mm. Color ferruginous, pleura and legs yellow. Mesonotum covered with fine appressed setulae, the supra-alar and scutellar bristles strong; no abdominal hairs. Middle tibiae with two long terminal spurs; hind legs as figured by Brues, showing the dorsal series of transverse rows of setulae, the two long apical tibial spurs, and the two dorsal longitudinal rows of contiguous setulae. Wings not preserved.

One specimen (A.M.N.H. No. 26611) from Station 14, the type locality, Miocene shales at Florissant, Colorado, is slightly smaller than the type and may have one or two fewer whorls of setulae on the hind tibiae.

### *Phora cockerelli* Brues

A female in the National Museum collection from R. D. Lacoe, from the Florissant shales, numbered 154, may well be included in Brues' species. Although the bristles of the legs have not been preserved, the hind metatarsi show the longitudinal rows of fine setulae as in the type, which also was discovered at Florissant. The antennae are not evident, but there is a faint indication of the wings, and altogether the specimen agrees very closely with Brues' original figure.

### *Phora*, sensu lato, *tumbae*, new species

Figure 60

Total length 4.2 mm.; head 0.4, thorax 1.5, abdomen about 2.4 mm. Head and thorax black, abdomen dark brown, the sclerites separated by light-colored membrane, the pale bands nearly as wide as the dark tergites; legs apparently testaceous in life, the hind femora enormously enlarged, front femora measur-

ing 1000 by 375  $\mu$ , middle femora 1375 by 475, hind femora 2200 by 1200; front tibiae 850 by 150, slightly curved and apparently compressed; middle tibiae 1050, fusiform, greatest width 240 at two-thirds the length, finely microscopically setulose and with a subdorsal close row of minute black setules, and with a long terminal spur present; hind tibiae 1600, compressed and curved, no bristles or setulae visible; front metatarsi much more slender than the tibiae, middle metatarsi flattened, with two widely separated dorsal rows of close-set setulae. Wings represented by only a vague indication of the root.

HOLOTYPE: A.M.N.H. No. 26612, from the Miocene shales, Florissant, Colorado, Station 14.

The two species of Phoridae described by Brues from Florissant differ from *tumbae* in the structure of the legs. The characteristic bristles are not preserved on the present specimen, only a few reclinate bristles being visible over the vertex. It is impossible to assign the species to any of the modern subdivisions of *Phora*.

*Tumbae*, Latin, from the grave.

#### ANTHOMYIIDAE

##### MECISTONEURON, NEW GENUS

Size small. Auxiliary vein distinct from first vein, ending near middle of wing, first vein ending well towards tip, in the usual position of the second vein, apical half of first three veins almost parallel, third vein ending at wing tip, fourth vein divergent, anterior cross vein almost at base of wing. Abdomen longer than wings, conically pointed. Tibiae apparently compressed. Details of chaetotaxy, leg structure, and anal field of wings not preserved.

Although the specimen lacks so many taxonomic characters that its exact location in the family cannot be stated, it is unique in its abbreviated first basal cell and in having a much larger first vein than any fly with which it could be confused, and hence it deserves a name *sui generis*.

GENOTYPE: The following species.

##### **Mecistoneuron perpetuum**, new species

Figure 63

FEMALE: Length of head 0.6 mm., thorax 1.5, abdomen 3.1; wings 3.3 by about 1.3 mm. Entirely black, wings hyaline, veins



fuscous. Auxiliary vein ending 1400  $\mu$  from root of wing, first vein ending 1150 from auxiliary and 750 from level of tip, straight-line distance between ends of first and second veins 750, between second and third veins 290, and between ends of third and fourth veins 480, prefurca 300, anterior cross vein 210 beyond prefurca and 300 before level of end of auxiliary vein, i.e., 1350 before end of first vein, width of marginal cell at end of first vein 200, of submarginal cell 210, of first posterior cell 390.

HOLOTYPE: A.M.N.H. No. 26613, from the Miocene shales, Florissant, Colorado, Station 13.

*Mecistoneuron*, Greek, μήκιστον, the longest, plus νεῦρον, vein; *perpetuum*, Latin, for all time.

### *Ophyra vetusta*, new species

Figure 64

Length, head and thorax together, 2 mm., abdomen 1.65 by 0.9, wing 2.7 by 0.95. Polished black; chaetotaxy destroyed, some scattered and disturbed coarse black hairs present on abdomen, the longest of which are about one-third the length of the segments; legs apparently blackish; wings hyaline, veins brown, the auxiliary vein ending 1200  $\mu$  from root of wing and 330 before end of first vein, first vein ending slightly beyond middle of wing, marginal cell 1050 along costa, prefurca 280, third vein ending at wing tip, sections of fourth vein proportioned 670:360:860  $\mu$ , anterior cross vein at middle of wing, and its length 100, posterior cross vein 310, anal cross vein 150, width of first posterior cell at middle 250, at tip 180, length of anal cell 350; calypteres not showing.

HOLOTYPE: A.M.N.H. No. 26614, from the Miocene shales at Florissant, Colorado, collected by Sievert A. Rohwer at Station 12.

The fly is most beautifully delineated in a spot of white marble on the drab shale.

The assignment of this species to the genus *Ophyra* is provisional. The absence of distinctive bristles makes it impossible to determine which of the multitude of modern anthomyiid genera, if any, should include the fossil. Although the species is small, its size need not exclude it from this complex group. The main reasons for locating it with *Ophyra* are the highly polished black body, setulose abdomen, freely ending auxiliary vein, lengthened first vein, long, narrow, parallel-sided first basal cell, relatively

long truncate anal cell, and slight forward curvature of the end of the fourth vein. In size the species suggests an acalypterate, but this combination of characters excludes it from each of the present-day families.

*Vetusta*, Latin, from ancient times.

#### LAUXANIIDAE

##### *Sapromyza veterana*, new species

Figure 67

Length 3.5 mm., head and thorax about 2, abdomen 2.4; wing 3.6 by 1.4. Apparently a yellowish insect in life, the coloration as preserved a light fuscous, wings flavescent. On the head two fronto-orbital and a pair of widely separated vertical bristles are present, indicating a wide separation of the eyes, but the antennae are not indicated. Of the thoracic bristles the humeral, one dorsocentral, one supra-alar, and the apical scutellars remain. Middle tibiae with strong pre-apical, hind tibiae with a smaller pre-apical. A seta present at base of costa. The first vein appears to end 1.5 mm. from the base of wing, the second vein almost at wing tip, third vein at extreme apex. The location of the cross veins is too vague to measure.

HOLOTYPE: U.S.N.M. No. 112557 (R. D. Lacoë collection), from the Miocene shales, Florissant, Colorado.

Although the specimen is but weakly depicted and lacks many of the supporting characters for definite placement in the genus *Sapromyza*, *sensu lato*, it presents the general habitus of such a species as the modern *Minettia flaveola*.

*Veterana*, Latin, old.

#### OTITIDAE (ORTALIDIDAE)

##### *Melieria (Ceroxys) calligrapha*, new species

Figure 62

MALE: Length about 7 mm., the end of the abdomen is curled under, so the fossil appears shorter than it actually is; head and thorax 3.5 mm., wing nearly 6 mm. Entire body and legs quite black. Mouth parts extruded, as long as head, thick. Wings in general hyaline, but marked with large brown spots, i.e., a broad transverse band extending from the costa across base of sub-marginal cell and anal cross vein, narrowing behind, a large spot surrounding the anterior cross vein and vaguely connected with

the dark end of the costal cell, a large spot surrounding the posterior cross vein, and an apical band beginning much before end of marginal cell opposite the posterior cross vein and extending to the tip of the fourth vein. Length of anterior cross vein  $400\ \mu$ , discal cell on first basal 1350, on first posterior 900, posterior cross vein 750, base of discal cell to end of anal about 400.

Although no bristles show on the anterior part of the thorax, the wing pattern is so characteristically like that of existing species of *Melieria* that the species finds its best location in this genus.

HOLOTYPE: A.M.N.H. No. 26615, from the Miocene shales, Florissant, Colorado, discovered by William M. Wheeler at Station 14.

In its strikingly pictured wings the species presents a close resemblance to *Melieria atavina* Cockerell, also from Florissant shales. But it differs markedly in the location of the anterior cross vein, the formation of the anal cell, and absence of the basal spot of the wing. Cockerell's species has the anterior cross vein at almost the apical fourth of the discal cell and the anal cell considerably shorter than the second basal. In *calligrapha* the anterior cross vein is but slightly beyond the middle of the discal cell, and the second basal and anal cells are coëxtensive.

*Calligrapha*, Greek, beautifully pictured.

#### SEPSIDAE

##### *Themira saxifica*, new species

Figure 65

FEMALE: Length 4.3 mm.; head and thorax 2.4, abdomen 2.5 by 1.8; wing 3.5 by 0.5. Entirely black, shining, wings hyaline, veins brown; only a very few short abdominal hairs preserved. First vein ending  $1850\ \mu$  from level of tip of wing and 500 beyond end of auxiliary vein, second vein measuring 2400 to prefurca which is 350 long, third vein 2750, front edge of discal cell 830 to cross vein and 670 beyond it, last section of fourth vein 1200 and angled at posterior cross vein, length of anterior cross vein 200, of posterior cross vein 400, width of first posterior cell at end of fourth vein 320, width of submarginal cell at end of second vein 320.

HOLOTYPE: A.M.N.H. No. 26616, from the Miocene shales at Florissant, Colorado, collected by Sievert A. Rohwer at Station 11.

A second specimen, A.M.N.H. No. 26616/1 from Station 13, shows the antennae, the third joint of which is twice as long as deep, apically rounded and with the slender bare arista arising well towards base; the anal cell is about  $450\ \mu$  long, with the cross vein just basad the end of the second basal cell, at first rounded and then reflexed.

The species has the general habitus of *Themira*, but since its bristles are not preserved its location in that genus cannot be stated with finality. The first vein is somewhat longer than in the modern species, but that seems to be a general characteristic of the Tertiary acalypterates. In the lengthened third antennal joint the species departs from recent themiras, which have this joint short and globular, and approaches *Sepsis*. It would seem that the lengthened antennae of *Sepsis* represent the generalized condition, but its short costal and subcostal cells are more specialized than the lengthened ones of *Themira*.

*Saxifica*, Latin, turned into stone.

#### PIOPHILIDAE

##### *Mycetaulus incretus*, new species

Figure 69

FEMALE: Length of head and thorax 2.4 mm., of the deflexed abdomen about 2.7; wing 3.45 by 1.45 mm. Apparently black over all, anterior legs yellowish, hind legs fuscous but yellowish at base; wings hyaline, the apical sixth broadly infumated but the mark gradually merging proximally. Discal cell acuminate at base. The following alar measurements are in microns: length of first vein 1800, second vein from prefurca 2400, third vein 2840, width of costal cell at middle 210, width of marginal cell at end of first vein 300, width of submarginal cell at end of first vein 225, at apex of second vein 360, length of prefurca 340, length of anterior cross vein 180, of posterior cross vein 450, sections of fourth vein 840:800:1200, sections of fifth vein 1650:240, apical width of first posterior cell 360.

HOLOTYPE: A.M.N.H. No. 26617, from the Miocene shales, Florissant, Colorado, Station 13.

The dark cloud at the apex of the wing suggests the genus *Mycetaulus*, but the absence of bristles makes it impossible to pronounce with certainty that the fossil belongs to this genus. The insect closely resembles the modern *Mycetaulus polyperi*

Melander, but is larger, darker, has broader wings, with slightly different proportions to the sections of the veins. The existing species of *Mycetaulus* vary as much in wing structure and neuration and in range of color, though all are smaller than the Tertiary species.

*Incretus*, Latin, covered by sifting ashes.

### TRICHOSCELIDAE

#### *Trichoscelis patefacta*, new species

Figure 71

Head and thorax 1.8 mm., abdomen about 2; wing 3 mm. Quite like the present-day species of *Trichoscelis*, with the costa furnished with nearly uniform spines. Some of the characteristic macrochaetae and scattered mesonotal setulae retained, including the oral vibrissa and the apical spine on the hind tibia. Alar measurements in microns: end of first vein from humeral cross vein 750, end of auxiliary vein to end of first vein 260, length of second vein from point below end of first vein 1800 or from prefurca 2350, length of third vein from prefurca 2600, distance between tips of second and third veins 500, upper side of discal cell to anterior cross vein 600, from anterior to posterior cross vein 720, width of first posterior cell at end of discal 360, first posterior cell on second posterior 1150.

HOLOTYPE: A.M.N.H. No. 26618, from the Florissant shales at Station 13, found by William M. Wheeler.

The species apparently closely resembles *Heteromyella miocenica* Cockerell, but it is much smaller and has smaller wings, with the first vein relatively shorter and largely fused with the auxiliary vein, and with the anterior cross vein located beyond the end of the first vein and before the middle of the discal cell. *Heteromyella* appears to be a true helomyzid, but the present species belongs to the Trichoscelidae.

*Patefacta*, Latin, brought to light.

### AGROMYZIDAE

#### *Agromyza praecursor*, new species

Figure 70

FEMALE: Length about 4 mm.; head and thorax 1.8, abdomen 2.2. A black, bristly species with large antennae; fossilized

in profile, the right wing pressed against the abdomen so as to obscure the neurulation and the distal part of the wing broken off. Antennae much as in the modern *Agromyza luctuosa* Meigen, the third joint deeply rotund. Four dorsocentral bristles visible, as well as notopleural, intra-alar, apical, and lateral scutellars. Interstices of abdomen narrowly light colored, with a transverse row of bristles just before the bands.

HOLOTYPE: A.M.N.H. No. 26619, from the Miocene shales at Florissant, Colorado, Station 14, discovered by William M. Wheeler.

The species is so much like *Agromyza luctuosa* Meigen (= *magnumcornis* Loew, North America, and *grossicornis* Zetterstedt, Europe) that the difference in their ages seems incredible.

*Praecursor*, Latin, a forerunner.

### **Melanagromyza prisca**, new species

Length 2.8 mm. Thorax and abdomen shining black, front and vertex brownish, wings hyaline, veins fuscous. Wings 2.4 by 1.08 mm. The following data are in microns: costa broken at end of first vein 870 from base, second vein ending 1230 beyond first vein, distance between ends of second and third veins 330, costa continuing beyond tip and probably to fourth vein (the fossil abraded at this place), prefurca about 200, anterior cross vein well beyond end of first vein, 400 from prefurca, sections of fourth vein 450:400:750, sections of fifth vein 930:420, length of anterior cross vein 90, of posterior cross vein 300.

HOLOTYPE: A.M.N.H. No. 26620, from the Miocene shales at Florissant, Colorado, Station 4.

The fossil shows a little black lump on the right side, where the knob of the halteres should be. For this reason the species is placed in Hendel's genus *Melanagromyza* rather than in *Agromyza*, *sensu lato*.

*Prisca*, Latin, belonging to former times.

### **Melanagromyza tephrias**, new species

Figure 66

FEMALE: Length 3.75 mm., the head and thorax about 1.8, the abdomen about 1.95 mm. Apparently a black species with yellow legs, the abdomen with pale interstitial bands. The fly is preserved in profile view, but the wings are pressed together so

as to obscure the measurement of parts. There is a small blackened knob at the place where the halteres should be; hence the generic placement in *Melanagromyza*. The costa is continued beyond the end of the third vein.

HOLOTYPE: A.M.N.H. No. 26621, from the Miocene shales, Florissant, Colorado, Station 4.

Although the specimen does not contribute much information it establishes the existence of yellow-legged agromyzas in the Tertiary.

*Tephrias*, Greek *τεφριος*, a stone formed of ashes.

### MUSCOID PUPARIUM

#### Figure 68

Two coarctate puparia were discovered at Station 4, marked A.M.N.H. Nos. 26622:1, 26622:2. They measure 5 by 2.5 mm., are dark brown in color and show about 12 somites. They are bare, not wrinkled along the interstices, and possess no definite protuberances, tubercles, button, or cavities. At the posterior end No. 26622:2 shows a small, shallow, oval, unchitinized pit, but paired spiracular plates are not evident. At the rear of this pit are four or five small, black, chitinized points directed inward.

The systematic location of these puparia is doubtful, so they are merely enumerated here without name.

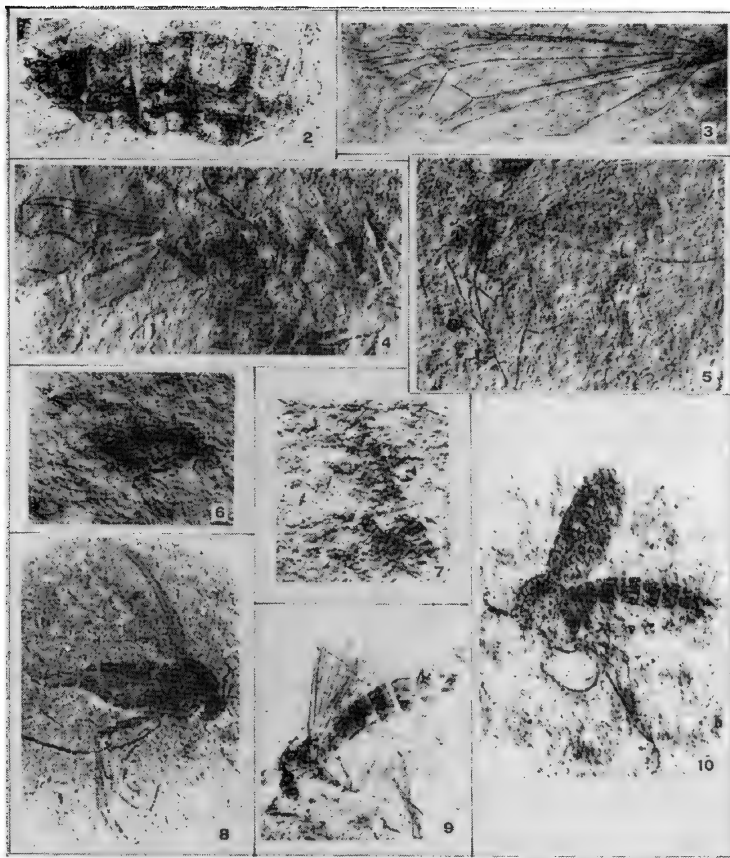


FIG. 2. *Tipula wilmatteae*, new species, original size 14 mm., holotype, A.M.N.H. No. 26452. Tipulidae.

FIG. 3. *Tipula florissanta* Scudder, length of wing 18 mm., A.M.N.H. No. 26453. Tipulidae.

FIG. 4. *Diamesa extincta*, new species, length of wing 4 mm., holotype, A.M.N.H. No. 26467. Chironomidae.

FIG. 5. *Proapemon infernus*, new genus, new species, length 6 mm., holotype, A.M.N.H. No. 26463. Mycetophilidae.

FIG. 6. *Sciara dormitans*, new species, length 4.2 mm., holotype, A.M.N.H. No. 26464. Sciaridae.

FIG. 7. *Sciara requieta*, new species, length 4.2 mm., holotype, A.M.N.H. No. 26465. Sciaridae.

FIG. 8. *Sciara sopora*, new species, length 3.5 mm., holotype, A.M.N.H. No. 26466. Sciaridae.

FIG. 9. *Exechia priscula*, new species, length 5.5 mm., holotype, A.M.N.H. No. 26462. Mycetophilidae.

FIG. 10. *Boletina hypogaea*, new species, length 5.1 mm., holotype, U.S.N.M. No. 112571. Mycetophilidae.



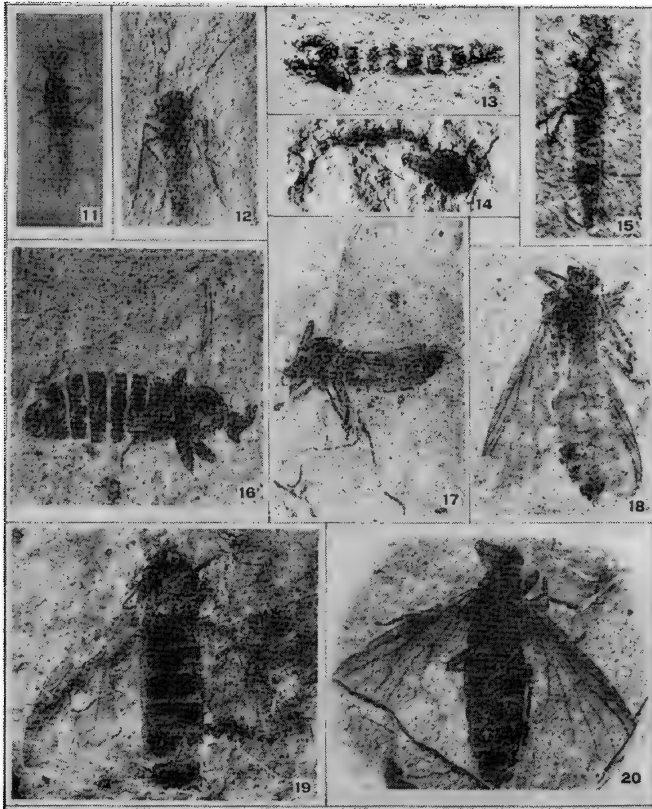


FIG. 11. *Chironomus proterus*, new species, male, length 5.5 mm., holotype, Br.M.N.H. No. I. 7359. Chironomidae.

FIG. 12. *Chironomus proterus*, new species, female, length 6.3 mm., allotype, Br.M.N.H., No. I. 7358. Chironomidae.

FIG. 13. *Chironomus requiescens*, new species, pupa, length 9 mm., holotype, A.M.N.H. No. 26474:1. Chironomidae.

FIG. 14. *Chironomus pausatus*, new species, pupa, length 6.5 mm., holotype, A.M.N.H. No. 26473. Chironomidae.

FIG. 15. *Chironomus primaevus*, new species, length 7 mm., holotype, A.M.N.H. No. 26469:1. Chironomidae.

FIG. 16. *Reichertella fasciata*, new species, length 3.8 mm., holotype, U.S. N.M. No. 112563. Scatopsidae.

FIG. 17. *Hesperinus immutabilis*, new species, length 9 mm., paratype, U.S.N.M. No. 112588. Bibionidae.

FIG. 18. *Penthetria longifurca*, new species, length 9.25 mm., holotype, U.S.N.M. No. 112551. Bibionidae.

FIG. 19. *Plecia gradata*, new species, length 11.5 mm., holotype, A.M.N.H. No. 26481. Bibionidae.

FIG. 20. *Plecia tessella*, new species, length 11 mm., holotype, U.S.N.M. No. 112562. Bibionidae.

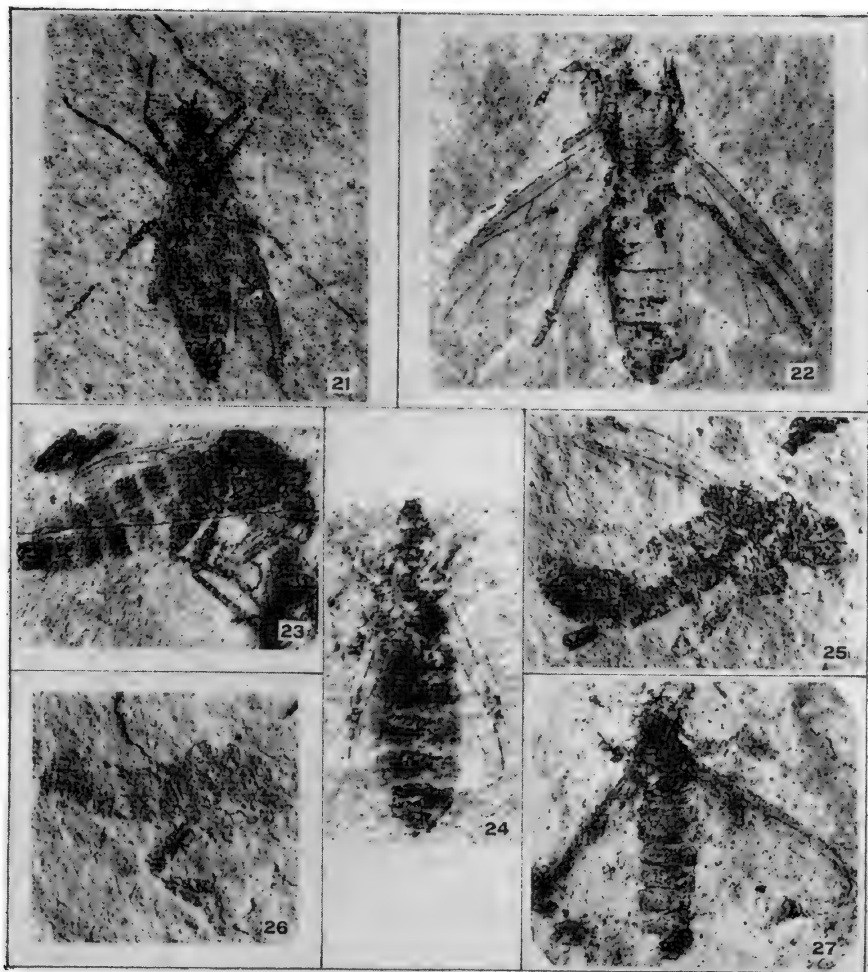


FIG. 21. *Plecia vrycta*, new species, length 7.7 mm., holotype, U.S.N.M. No. 112569. Bibionidae.

FIG. 22. *Bibio wickhami* Cockerell, length 13 mm., A.M.N.H. No. 26490/2: 1. Bibionidae.

FIG. 23. *Bibio cockerelli* James, length 8 mm., graphotype, A.M.N.H. No. 26484/2: 1. Bibionidae.

FIG. 24. *Bibio cockerelli* James, length 11 mm., graphotype, U.S.N.M. No. 112585. Bibionidae.

FIG. 25. *Bibio podager*, new species, length 8 mm., holotype, A.M.N.H. 26487. Bibionidae.

FIG. 26. *Bibio jamesi*, new species, length 7 mm., holotype, A.M.N.H. No. 26486. Bibionidae.

FIG. 27. *Bibio excurvatus*, new species, length 7.75 mm., holotype, U.S.N.M. No. 112550. Bibionidae.

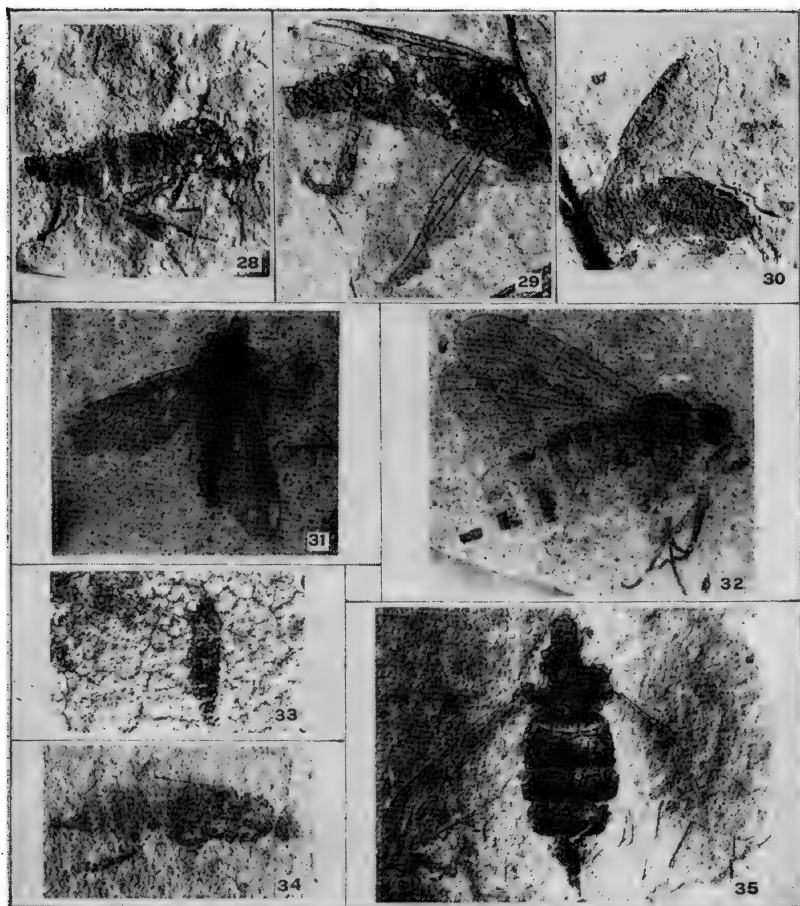


FIG. 28. *Bibio explanatus*, new species, length 11.5 mm., holotype, A.M.N.H. No. 26485. Bibionidae.

FIG. 29. *Bibio vulcanius*, new species, length 9 mm., holotype, U.S.N.M. No. 112564. Bibionidae.

FIG. 30. *Bibio capnodes*, new species, length 9 mm. without head, holotype, U.S.N.M. No. 112565. Bibionidae.

FIG. 31. *Rhagio fossitius*, new species, length 7 mm., holotype, U.S.N.M. No. 112626. Rhagionidae.

FIG. 32. *Rhagio wheeleri*, new species, length 9 mm., paratype graphotype, A.M.N.H. No. 26496:2. Rhagionidae.

FIG. 33. *Solva (Xylomyia) inornata*, new species, length 9.5 mm., holotype, U.S.N.M. No. 112568. Rhagionidae.

FIG. 34. *Dialysis revelata* Cockerell, length 19 mm., A.M.N.H. No. 26495. Rhagionidae.

FIG. 35. *Neorhynchocephalus occultator* (Cockerell), length 19 mm., A.M.N.H. No. 26497. Nemestrinidae.

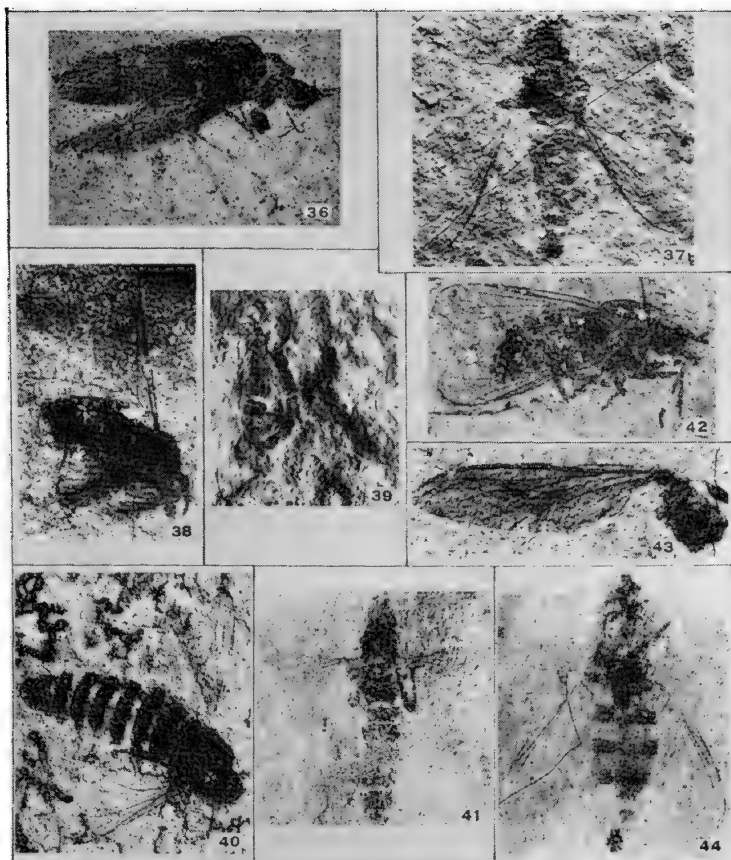


FIG. 36. *Nebritus willistoni*, new species, length 6.5 mm., holotype, U.S.N.M. No. 112553. Therevidae.

FIG. 37. *Amphicosmus delicatulus*, new species, length 4.85 mm. counterotype, A.M.N.H. No. 26600A. Bombyliidae.

FIG. 38. *Protophthiria atra*, new species, length 7.5 mm., holotype, U.S.N.M. No. 112552. Bombyliidae.

FIG. 39. *Alepidophora minor*, new species, length 6.75 mm., holotype, A.M.N.H. No. 26498. Bombyliidae.

FIG. 40. *Alepidophora cockerelli*, new species, length 9.25 mm., holotype, A.M.N.H. No. 26499. Bombyliidae.

FIG. 41. *Melanderella testea*, new species, length 9.5 mm., holotype, U.S. N.M. No. 112553. Bombyliidae.

FIG. 42. *Apolysis magister* Melander, length 6.25 mm., paratype, U.S.N.M. No. 112573. Bombyliidae.

FIG. 43. *Senoprosopis eureka*, new species, length of wing 13 mm., holotype, A.M.N.H. No. 26602. Asilidae.

FIG. 44. *Platycheirus lethaeus*, new species, length 7 mm., holotype, Univ. Colorado No. 19899. Syrphidae.

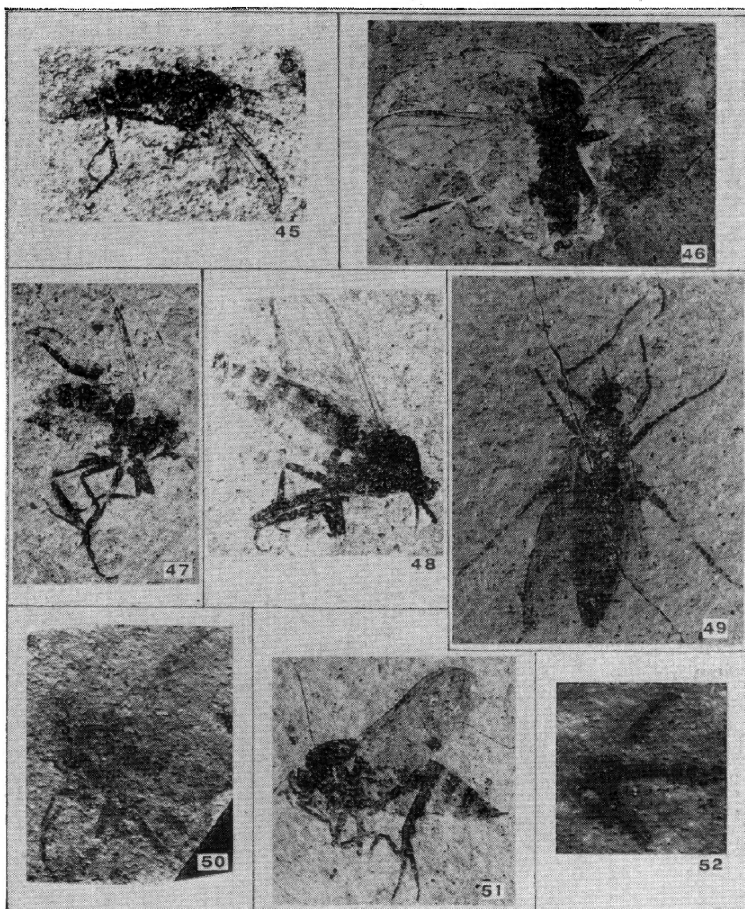


FIG. 45. *Acallomyia probolaea*, new species, length 4.7 mm., holotype, A.M.N.H. No. 26603. Empididae.

FIG. 46. *Rhamphomyia aeterna*, new species, length 6.4 mm., holotype, A.M.N.H. No. 26604. Empididae.

FIG. 47. *Rhamphomyia infernalis*, new species, length 4.75 mm., holotype, U.S.N.M. No. 112556. Empididae.

FIG. 48. *Rhamphomyia tumultata*, new species, length 6.1 mm., holotype, A.M.N.H. No. 26608. Empididae.

FIG. 49. *Empis infossa*, new species, length 7.8 mm., holotype, U.S.N.M. No. 112625. Empididae.

FIG. 50. *Rhamphomyia morticina*, new species, length 6.5 mm., type (female), Br.M.N.H. No. I. 7361. Empididae.

FIG. 51. *Rhamphomyia fossa*, new species, length 5.5 mm., holotype (female), U.S.N.M. No. 112567. Empididae.

FIG. 52. *Rhamphomyia morticina*, new species, length 6.5 mm., type (male), Br.M.N.H. No. I. 7362. Empididae.

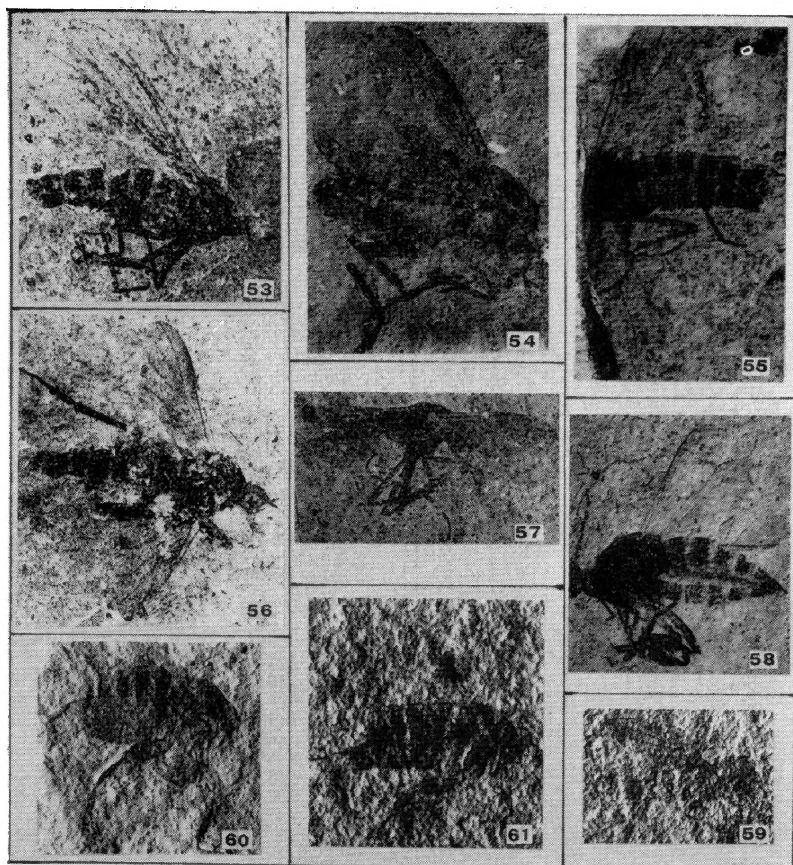


FIG. 53. *Rhamphomyia senecta*, new species, length 6 mm., holotype, A.M.N.H. No. 26606. Empididae.

FIG. 54. *Rhamphomyia craterae*, new species, length 8 mm., holotype, U.S.N.M. No. 112561. Empididae.

FIG. 55. *Rhamphomyia spodites*, new species, length 5.75 mm., holotype, A.M.N.H. No. 26607. Empididae.

FIG. 56. *Rhamphomyia inanimata*, new species, length 7.8 mm., countertype, U.S.N.M. No. 112586. Empididae.

FIG. 57. *Rhamphomyia fossa*, new species, length 4.7 mm., allotype (male), U.S.N.M. No. 112583. Empididae.

FIG. 58. *Rhamphomyia interita*, new species, length 6.75 mm., holotype, A.M.N.H. No. 26605. Empididae.

FIG. 59. *Tachypeza primitiva*, new species, length 7 mm., holotype, U.S.N.M. No. 112566. Empididae.

FIG. 60. *Phora tumbae*, new species, length 4.2 mm., holotype, A.M.N.H. No. 26612. Phoridae.

FIG. 61. *Phora laminarum* Brues, length 3.5 mm., graphotype, A.M.N.H. No. 26611. Phoridae.



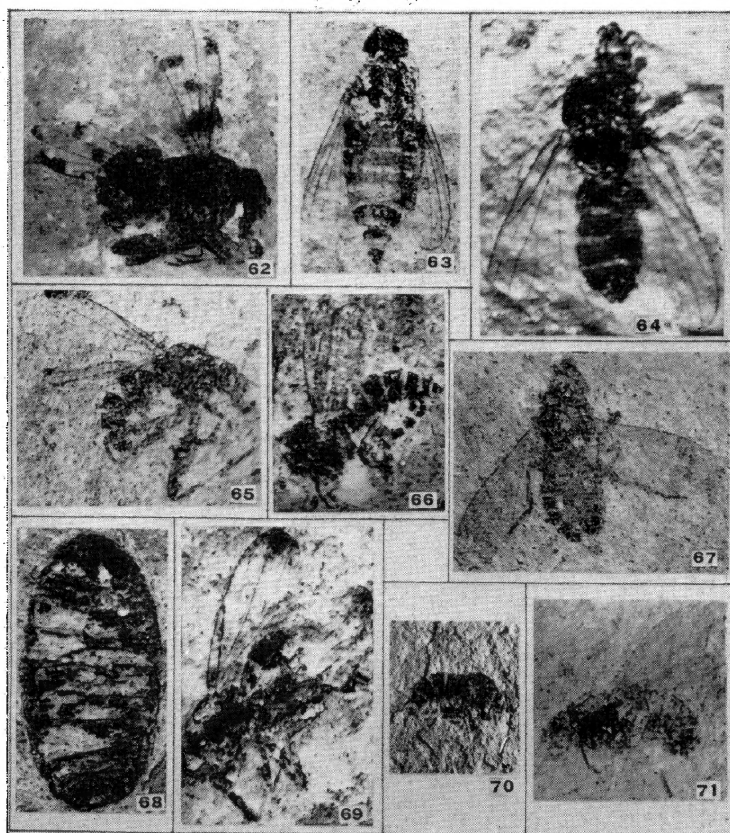


FIG. 62. *Melieria (Ceroxys) calligrapha*, new species, length 7 mm., holotype, A.M.N.H. No. 26615. Otitidae.

FIG. 63. *Mecistoneuron perpetuum*, new genus, new species, length 5.2 mm., holotype, A.M.N.H. No. 26613. Anthomyiidae.

FIG. 64. *Ophyra vetusta*, new species, length 3.65 mm., holotype, A.M.N.H. No. 26614. Anthomyiidae.

FIG. 65. *Themira saxifica*, new species, length 4.3 mm., paratype, A.M.N.H. No. 26616/1. Sepsidae.

FIG. 66. *Melanagromyza tephrias*, new species, length 3.75 mm., holotype, A.M.N.H. No. 26621. Agromyzidae.

FIG. 67. *Sapromyza veterana*, new species, length 3.5 mm., holotype, U.S. N.M. No. 112557. Lauxaniidae.

FIG. 68. Muscoid puparium, size 5 by 2.5 mm., A.M.N.H. No. 26622:2.

FIG. 69. *Mycetaulus incretus*, new species, length 5 mm., holotype, A.M.N.H. No. 26617. Piophilidae.

FIG. 70. *Agromyza praecursor*, new species, length 4 mm., holotype, A.M. N.H. No. 26619. Agromyzidae.

FIG. 71. *Trichoscelis patefacta*, new species, length 1.8 mm., holotype, A.M. N.H. No. 26618. Trichoscelidae.

